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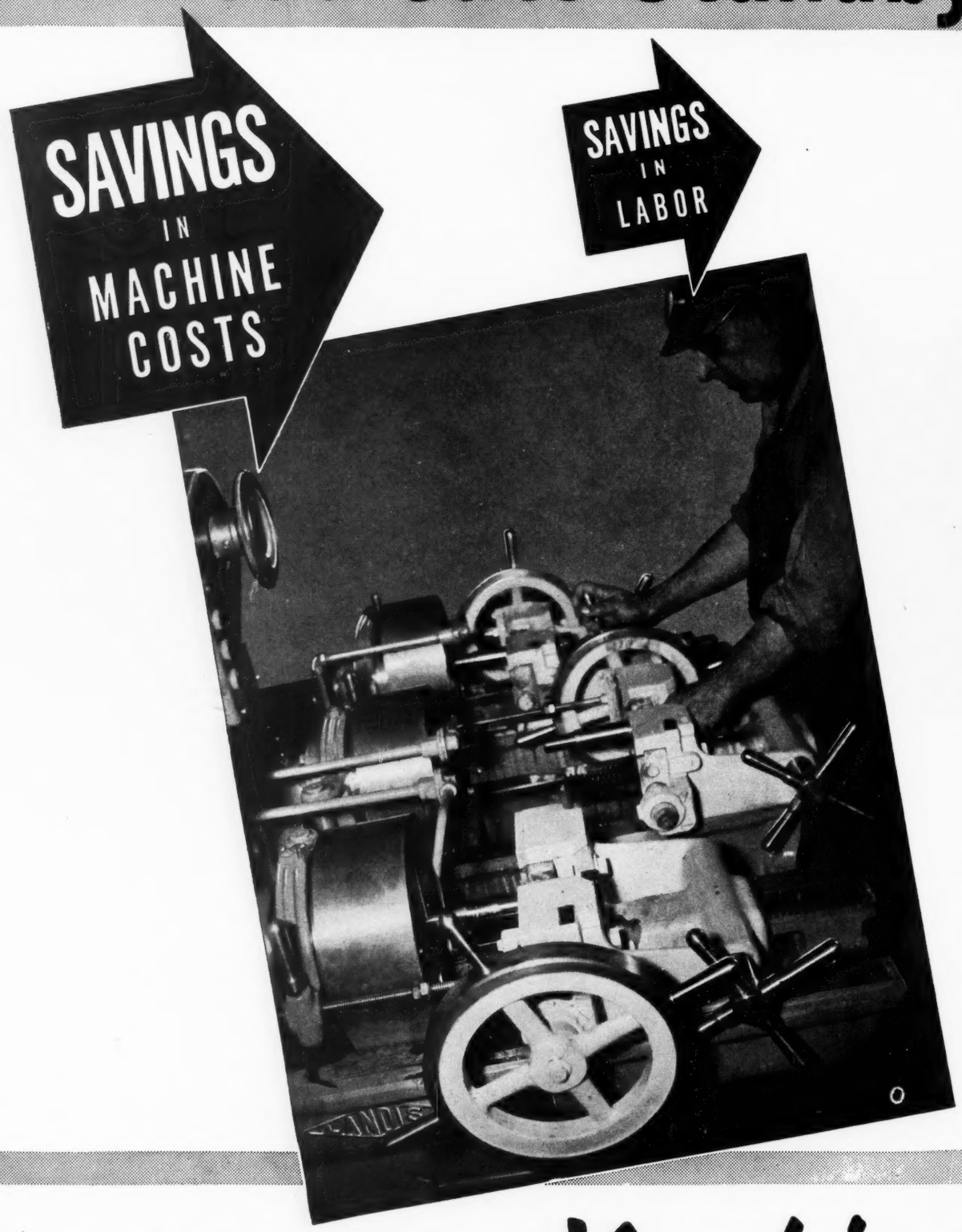


The LANDIS Machine

MACHINERY
Vol. 56 SEPTEMBER, 1949 No. 1

Short-Run Piercing of Holes by Fast, Economical Methods

Unusual Devices Employed to Economically Punch Holes of Various Sizes and Shapes for Mounting Condensers, Relays, Transformers, and Other Apparatus in Panels for Electrical Equipment

By GEORGE H. DeGROAT

EFFICIENT equipment and tooling are required to economically punch holes of various sizes and shapes in work that is produced in small quantities. Several unusual devices are used by the Western Electric Co., Inc., Kearny, N. J., for this purpose in the production of apparatus mounting panels for electrical equipment. Various shapes and sizes of holes have been standardized for mounting specific apparatus, such as condensers, transformers, relays, resistances, etc. These holes must be punched in locations in the various panels to suit the particular application for which the panel is required in the field.

A great deal of this kind of work is handled by the Wiedemann turret punch press shown in the heading illustration, which is equipped with a unique work positioning device. This turret punch press contains eighteen sets of hardened high-speed steel punches and dies made to suit

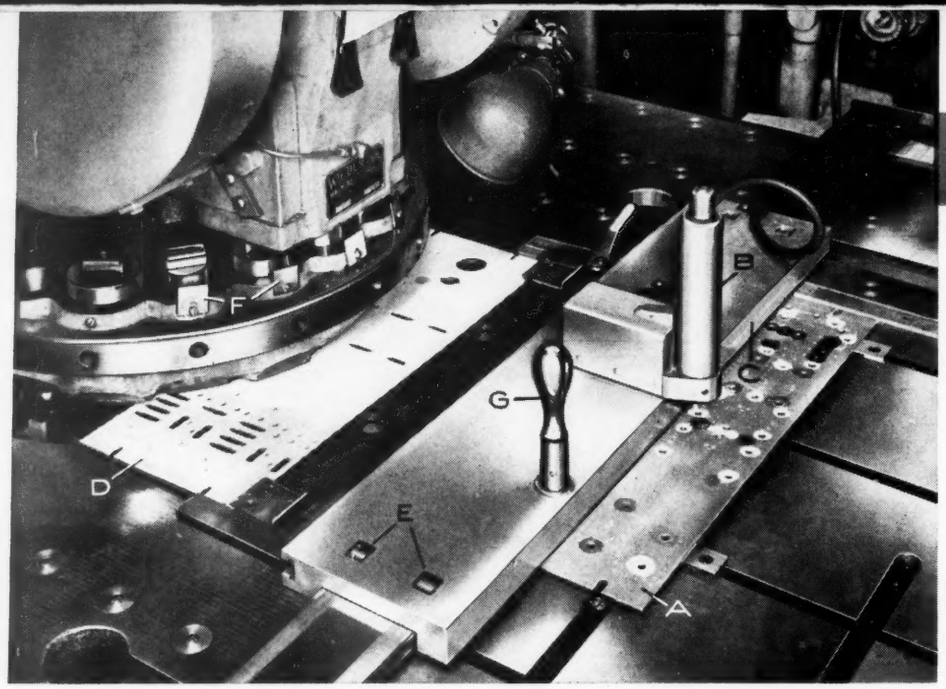


Fig. 1. Work positioning attachment on a turret punch press utilizes a templet for quickly and accurately perforating holes in panels

the holes of different shapes and sizes that are required. The upper turret, containing the punches, and the lower turret, which holds the dies, can be indexed together to bring any particular punch and die set into position relative to the work. With each indexing the punch and die are automatically locked to prevent misalignment during operation. Locking is accomplished by means of pins which engage the upper and lower turrets of the punch press.

The work is clamped to carrier *C*, Fig. 1, and is moved longitudinally and transversely with the carrier. A templet for positioning the work for each stroke of the press is clamped in a stationary position on the press table, as illustrated at *A*. This templet has round holes of one size that are accurately laid out to correspond with the location of the various shaped holes desired in the work. A plunger *B*, attached to work-carrier *C*, is inserted successively in the templet holes to position the carrier, and thus work *D*, under the punches as required for piercing each hole. The longitudinal and transverse movements of the work-carrier are considerably

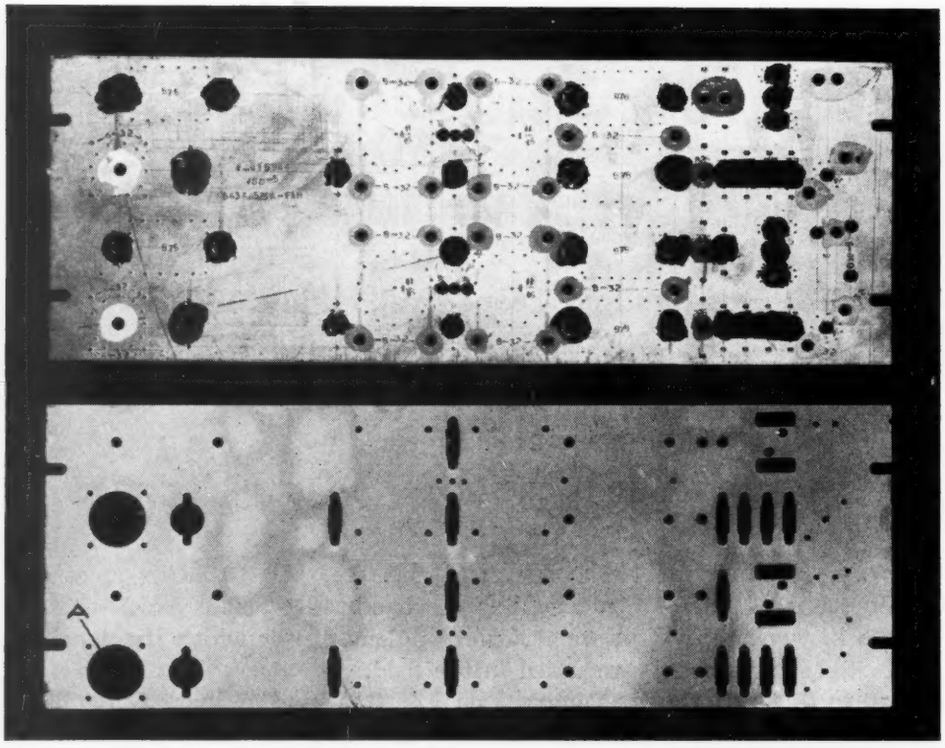


Fig. 2. Typical apparatus mounting panel and templet. Plates of this type are perforated for mounting condensers, relays, transformers, etc., in electrical equipment

facilitated by the use of ball bearing mountings, two of which may be seen at *E*.

As the plunger is depressed to fully engage a hole in the templet, it actuates a limit switch to trip the press. In this way, the punch and die which have been indexed to the working position produce a hole in the work. Accidental tripping of the press before the locating plunger is fully aligned with the templet hole is prevented because the limit switch does not function until the plunger has been fully depressed. The limit switch then energizes a solenoid which actuates the ram clutch pin to trip the press.

Colored tabs *F* are fastened to the die stations in the turret, a different color being used to indicate the type of hole produced at each of the eighteen stations. The templet holes are circled in colors corresponding to the tabs, the color depending upon the type of hole required at each location. As a result of this color code, the operator can easily determine the shape and size of hole that will be punched at the various positions. After indexing the turret to a given station, all the holes of that type which may be required are perforated in the work by successively engaging the templet holes with color circles corresponding to the tab at the die station. When these holes have been produced, the turret is indexed again and the procedure repeated for holes of a different shape and size.

The perforating of rows of holes is speeded up by the use of clamps which prevent the movement of the work-carrier and plunger in a direction at right angles to the direction of the row being perforated. For example, when a row of holes is to be punched in a longitudinal direction, a lock *G* is twisted to prevent transverse movement. The operator actuates lock *G* with his left hand and depresses the plunger with his right hand. A lever type clamp, which may be seen in the foreground of the heading illustration, prevents longitudinal movement of the work-carrier and plunger when perforating a row of holes in a transverse direction.

Most of the apparatus mounting panels perforated in this manner are low-carbon steel or aluminum sheet up to 1/8 inch thick. A panel containing 100 holes may be seen at the bottom in Fig. 2, and the templet is shown above it. This panel required eighty strokes for complete perforation and was handled at the press only once. By comparing the templet with the completed

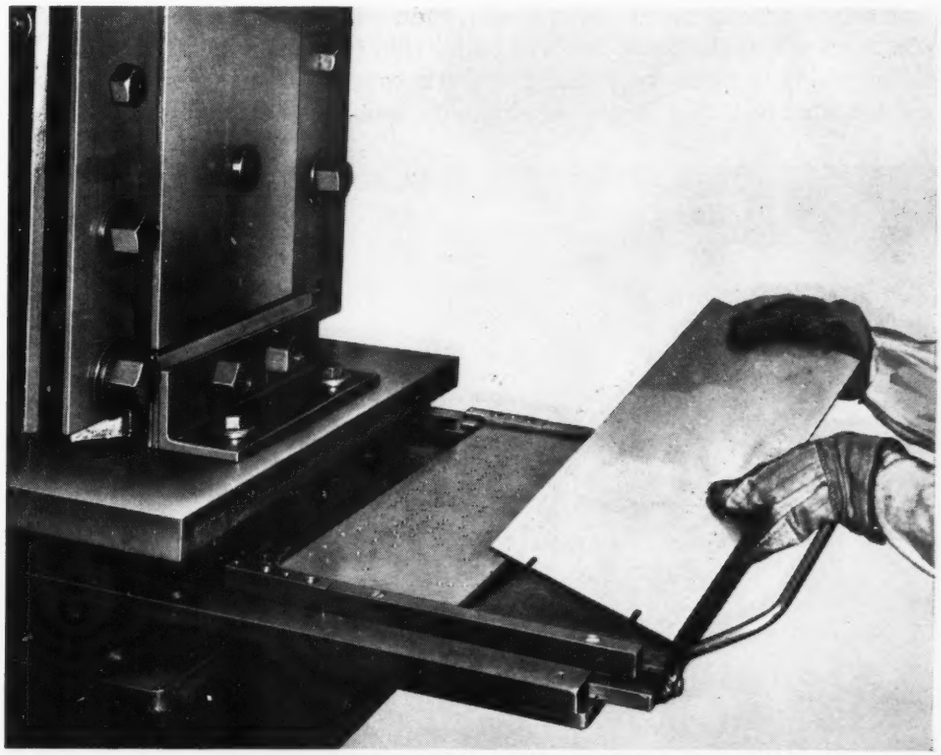


Fig. 3. A master templet is employed to spot hole centers in apparatus mounting plates at one stroke of the press, thus eliminating spot-drilling and the use of drill jigs

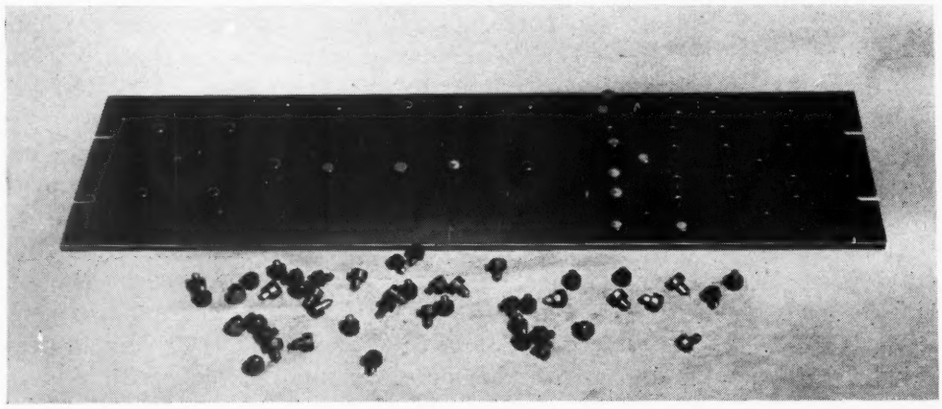


Fig. 4. Center punches are inserted into accurately located holes in templets for spotting panels in a press

panel, it will be apparent that certain groups of holes, such as those indicated at *A*, are perforated at a single station, where the die produces several holes. Hole locations are held to within plus or minus 0.008 inch, and work of this type can be produced at the rate of twelve panels an hour.

Besides improving the quality of the work, the advantages gained by this arrangement include the elimination of location spotting and drilling of holes, together with such attendant operations as deburring. It is a safe method of punching holes because the operator does not handle the work at the dies. Moreover, transferring the work between machines has been greatly reduced.

In cases where the work requires both drilling and punching, a standard punch press arranged as illustrated in Fig. 3 is used to eliminate spot-drilling. A master templet is employed, having center punches fitted into accurately located holes, as shown in Fig. 4. This is clamped in the press and a panel blank placed over it so that all of the required holes are spotted at once when the press is tripped. Considerable time is saved by this method because it is unnecessary to clamp a templet to each piece of work for spot-drilling the holes.

Another type of apparatus mounting panel is long, narrow, and flat with holes of various shapes centered on a single row along the length. The perforations are made in a press brake containing a series of punches and dies, as illustrated in Fig. 5. Templets with numbered centering holes are available for each job. The numbers correspond to specific centers on the panel, enabling the operator to select the die for

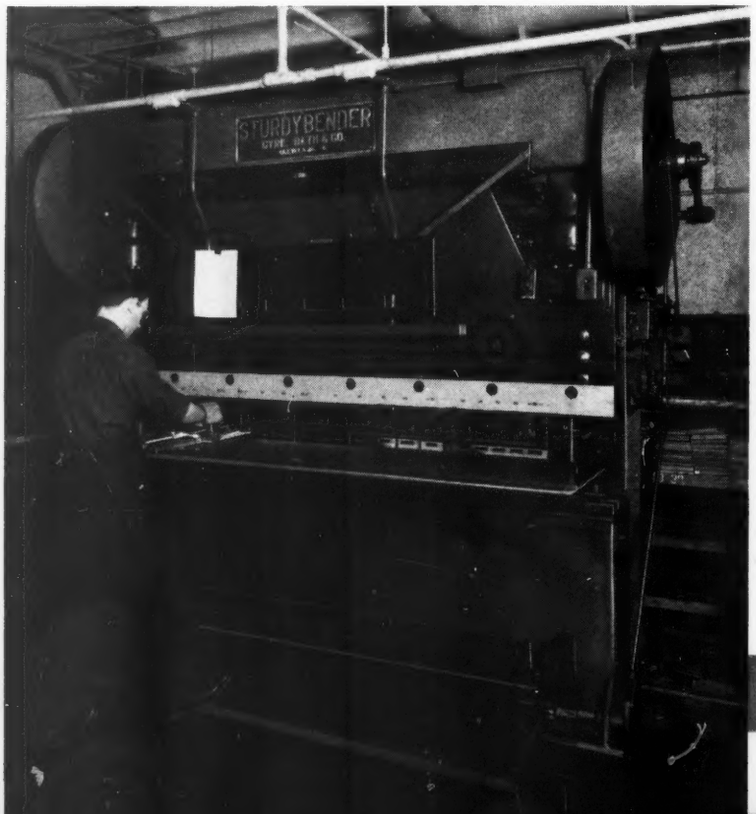


Fig. 5. Long, narrow, flat mounting panels are perforated in a press brake with a multiple-die set-up to produce holes of various shapes centered on a single row

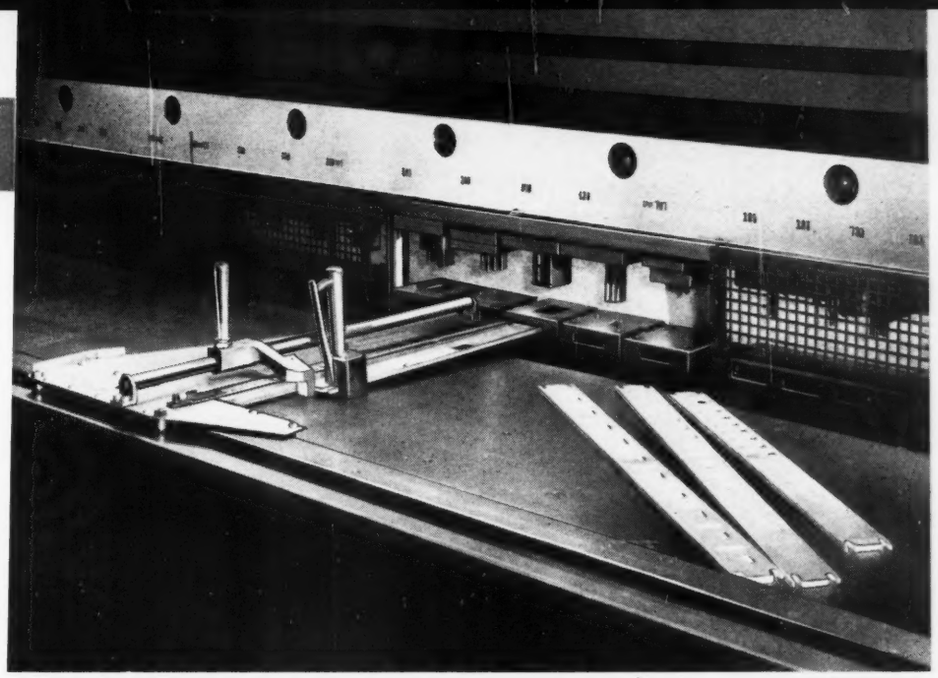


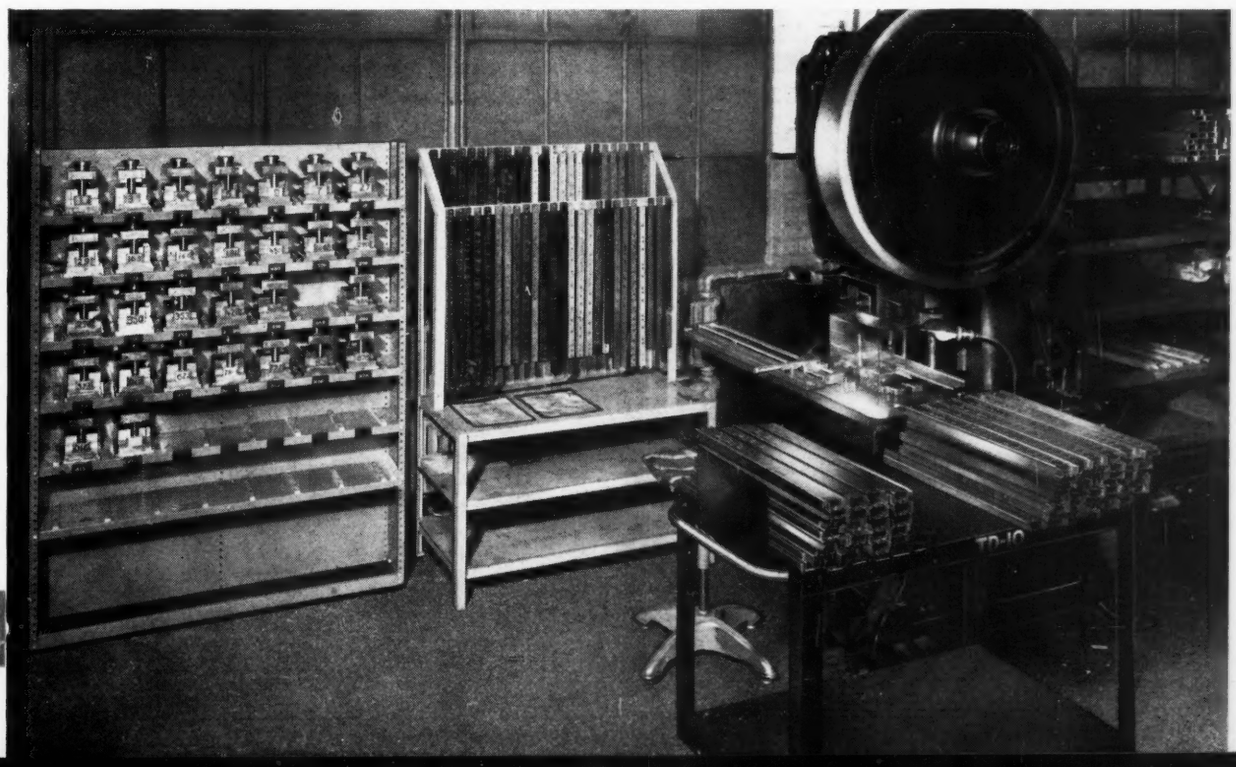
Fig. 6. Sliding fixtures having index fingers and templets are used to obtain proper spacing and types of holes required in flat mounting panels which have perforations in a single row

punching certain types of holes at specified centers. An indexing finger engages the numbered holes in the templet and provides a stop against which the work is located to obtain the correct position of the perforations. This device may be seen in Fig. 6, where typical mounting panels are shown on the press table. A guard has been removed in this illustration so that a few of the dies used in these operations may be seen.

Apparatus mounting panels of the channel type are perforated in an entirely different setup. These panels also have the various kinds of holes centered on a single row along their length. Interchangeable punches and dies are employed in conjunction with a master die-holder in a punch press, as shown in Fig. 7. Frequently used spacings between hole centers have been standardized and panels with these spacings are coded. Templets which have been provided for each of these codes, may be seen next to the cabinet containing the various dies required for holes of different shapes.

A numbering system similar to that described for the press brake arrangement is employed when using templets. Each die is numbered to identify the type of hole it produces, and the holes in the templets are numbered to correspond to the center positions required on the mounting plates. As may be seen in Fig. 8, a work locating arm with an indexing pin engages the templet holes as the operator selects specified centers. By using dies which produce the required open-

Fig. 7. Channel-shaped mounting panels are perforated in punch presses having dies which are quickly interchanged to produce various sizes and shapes of holes



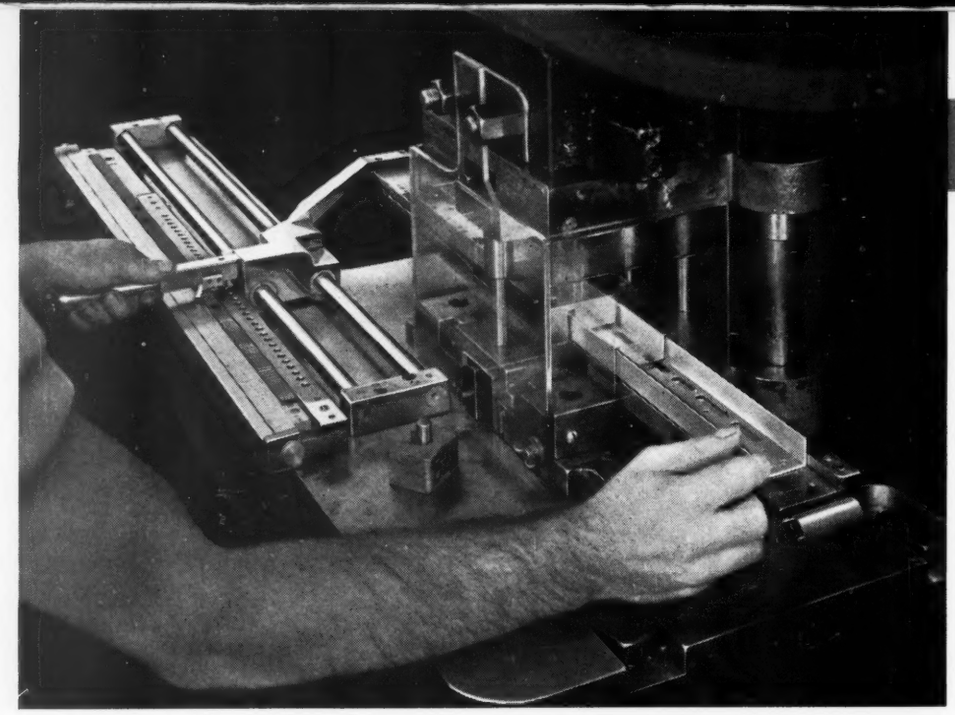


Fig. 8. Punch press set-up utilizing racks or templets for locating the centers of holes facilitates the spacing of perforations in the channel-shaped mounting panels

ings on these centers, the panels are perforated to order. All the holes of one type are punched in one set-up before changing dies. The master die-holder, illustrated in Fig. 9, permits the rapid interchanging of dies for each series of holes.

If panels having 1/8 inch center distances are to be perforated, a rack and scale are used in the same manner as that described for the templets. This is because it is not practical to have holes in templets spaced 1/8 inch apart. The racks have a 1/8 inch pitch and are engaged by teeth on the work locating arm, which is aligned with a scale fastened next to the rack. This arrangement may also be seen in Fig. 9.

When the rack is employed, the specifications for hole locations are also given by number, each number being applied to a center on a 1/8 inch pitch. For example, the blueprint may specify that centers numbered 4, 12, and 20 have holes suitable for a certain type of condenser, and that centers numbered 28 and 38 be perforated to suit a particular relay. A die that produces holes to suit the condenser is put in the press and the work fed through, punching the centers specified by referring to the center numbers on the scale and engaging the rack accordingly. When this operation is completed, the die is quickly removed and one that produces holes suitable for the specified relay inserted, after which the operation is repeated.

All the holes in each panel are perforated in one machine, thus eliminating handling of the parts between machines and operations. Set-up time has been reduced 90 per cent by utilizing the master die-holder arrangement. Initial tool costs, tool replacements, and maintenance have been reduced up to 50 per cent as the result of this design.

The simplicity and efficiency of these methods of perforating apparatus mounting plates and panels provide accuracy in production without expensive tooling or highly skilled labor.

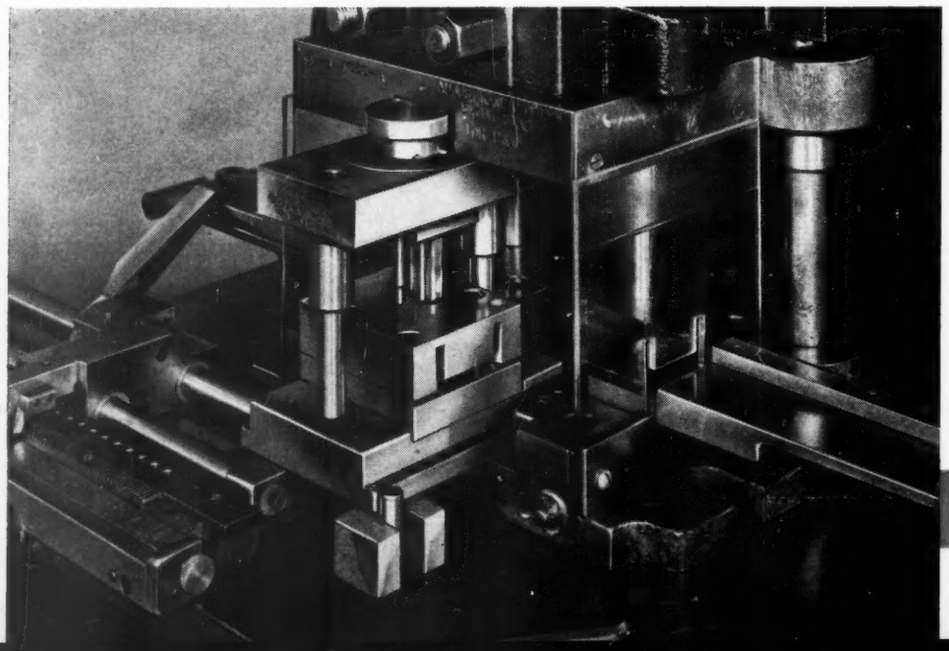


Fig. 9. Master die-holders permit the interchanging of dies in a matter of seconds for producing different types of holes in a punch press

Unusual Operations on Cylindrical and Centerless Grinders

The Flexibility of Standard Grinding Machines Permits Them to be Modified into Specialized Production Machines Capable of Finishing Many Different Materials in a Wide Variety of Shapes. Unusual Set-Ups on Centerless, Plain, Universal, and Cam-Grinding Machines are Described Here

By H. E. BALSIGER
Director of Engineering
Landis Tool Co., Waynesboro, Pa.

GRINDING machines are among the most important machine tools in modern day industry. They are capable of consistently duplicating parts to extremely close tolerances and with ultra-smooth surface finishes. Equally important as a contributing factor to the extensive use of grinding machines is their adaptability to finishing practically any material and a wide variety of shapes.

Ferrous and non-ferrous metals and alloys, carbides, powdered metals, plastics, glass, rubber, and ceramics are some of the materials commonly finished on grinding machines. Glass hypodermic-needle plungers are shown being finish-ground on the centerless grinding machine seen in the heading illustration. This machine is equipped with hydraulic rapid in-feed, slow grinding feed, hydraulic rapid return, and an air-operated work ejector. All that is required of the operator is to lay the work between the wheels and place the finished parts in the tray. To obtain the particular surface finish specified on the glass plungers, the 5-inch wide grinding wheel is reciprocated during the grinding cycle.

Parts having interrupted cylindrical surfaces, multiple diameters, tapered surfaces, long slender forms, and many other variations in shape can be economically finished on standard cylindrical grinding machines that have been modified by means of simple changes and additions to obtain a highly specialized production machine. Unusual and ingenious set-ups on centerless, plain, universal, and cam-grinding machines made by the Landis Tool Co., are described in this article.

Splined shafts having solid, integral keys are ground by a prominent manufacturer of machine tools on the 12- by 48-inch hydraulic universal grinder seen in Fig. 1. A special dead-spindle headstock with a hydraulically operated face-

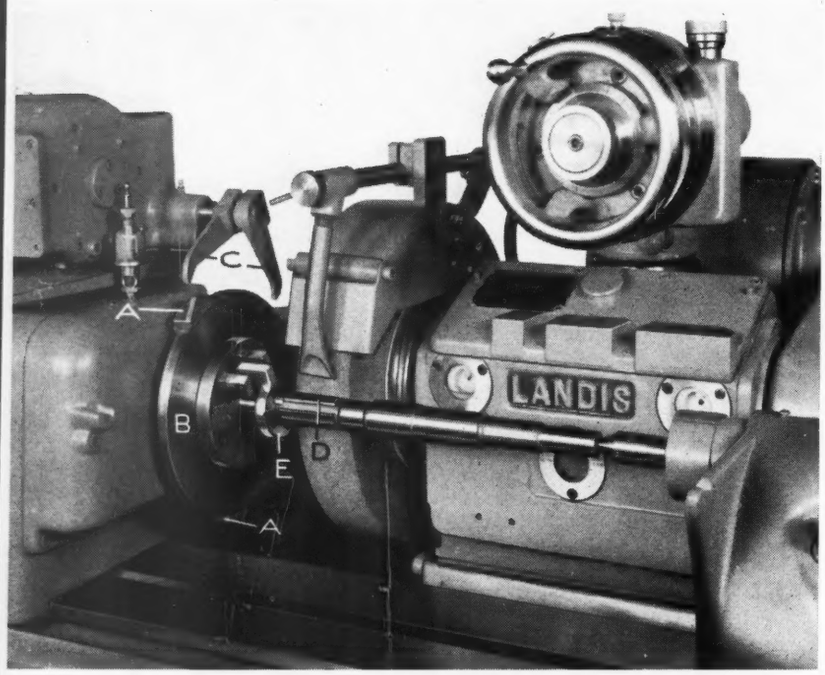


Fig. 1. Peripheries of splines on shafts having integral keys (D) are ground on this standard machine by employing a special dead-spindle headstock and hydraulically oscillating faceplate (B)

plate was designed, which oscillates the work about its own horizontal center line. Dogs *A*, mounted on the graduated faceplate *B*, actuate levers *C* to reverse the hydraulic motor whenever key *D* on the splined shaft approaches the grinding wheel. Rotation of the shaft is immediately reversed and the operation repeated, thus grinding the peripheries of the splines on the shaft without interfering with the raised key.

Work-driver *E* oscillates the shaft by applying torque to the key *D*. A second key is located on the right-hand end of the 14-inch shaft. A grinding wheel 14 inches in diameter by 2 inches wide is employed for this operation. The special dead-spindle headstock and hydraulically operated faceplate can be quickly removed from the swivel table and replaced by a standard headstock for conventional cylindrical grinding.

Converting the Centerless Grinder into a Chucking Machine

A good example of the flexibility designed into centerless grinding machines is the set-up shown in Fig. 2. The centerless grinder has been modified by removing the regulating wheel and converting the wheel mechanism into a live-spindle, work-driving arrangement, thus obtaining a chucking type grinding machine. Work-piece *A* is an internal helical gear, which is held on a special gear type chuck. With this method of mounting, the outside diameter of the gear can

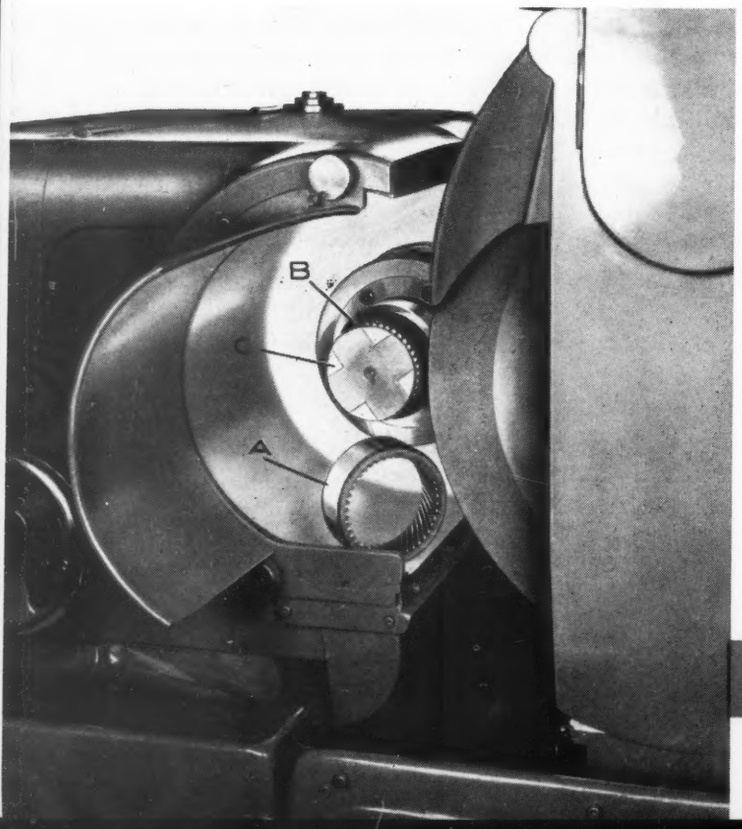


Fig. 2. Outside diameters of internal helical gears are ground concentric with the pitch line of the teeth on a centerless grinding machine having a special gear type chuck on the regulating wheel spindle

be ground concentric with the pitch line of the teeth. The gear is used on an automotive automatic transmission.

It will be noted that this ingenious chuck is not an expanding type of work-arbor. After slipping the internal gear onto the mating teeth of the chuck arbor *B*, the four triangular-shaped sectors *C* are pulled back on the arbor by means of a hydraulic chucking device built into the regulating wheel spindle. This changes the position of the teeth on the sectors in relation to those on the arbor, thus clamping the internal teeth of the work-piece. Upon the completion of the grinding operation, sectors *C* are returned to their original position, aligning them with the teeth on the arbor and permitting the gear to be removed.

This machine is equipped with hydraulic in-feed and a reciprocating grinding-wheel spindle that produces a high-quality surface finish on the part. The operation is semi-automatic, it being only necessary to load the part, start the in-feed, and remove the finished piece.

Use of Profile Grinding Wheels

Multiple-diameter work can be ground by the in-feed method in one operation on centerless grinders equipped with profile grinding wheels and spaced regulating wheels. Such a set-up is shown in Fig. 3. Samples of the work can be seen at the lower left on the front of the machine. The grinding wheel is profile-dressed by means of a standard overhead, hydraulically operated wheel dresser. To facilitate and speed up the removal of finished parts from the machine, the work-rest has a built-in, air-operated work ejector that also serves as a stock-stop during loading. The ejector is automatically actuated when the wheel-base returns to its back position.

The spaced regulating wheels are dressed with relation to each other by means of a reference type, dial gage indicator arrangement. A profile type dresser is not necessary for the simple step-dressing of the regulating wheels. All surfaces of multiple-diameter shafts need not be backed up by regulating wheels. To switch production from one shaped part to another, it is only necessary to change the grinding wheels, the stepped work-rest blade, and the profile bar that guides the dresser.

Plain cylindrical grinding machines are often used for simultaneously finishing several surfaces on multiple-diameter work by employing a profile grinding wheel mounted on a wheel-base set at an angle to the center line of the work, or by mounting several grinding wheels on one wheel-spindle. A 22- by 18-inch plain cylindrical grinder is seen in Fig. 4 with the wheel-base set at an angle of 40 degrees to the center line of the work. The operation consists of simultaneously grinding three concentric diameters on the part by means of a single profile grinding wheel.

Angular mounting of the wheel-base is necessary in this case so that the grinding wheel and its guard will clear that part of the work not being ground. Also, when adjacent bearing surfaces on a part are joined by shoulders or fillets (as is the case with the part shown), smoother surface finishes and greater production can generally be obtained by using an angularly mounted wheel instead of a straight wheel dressed to grind the shoulders or fillets.

A power-operated, profile wheel truing device *A* is built into the footstock base of the machine shown. The action of the diamond dressing tool

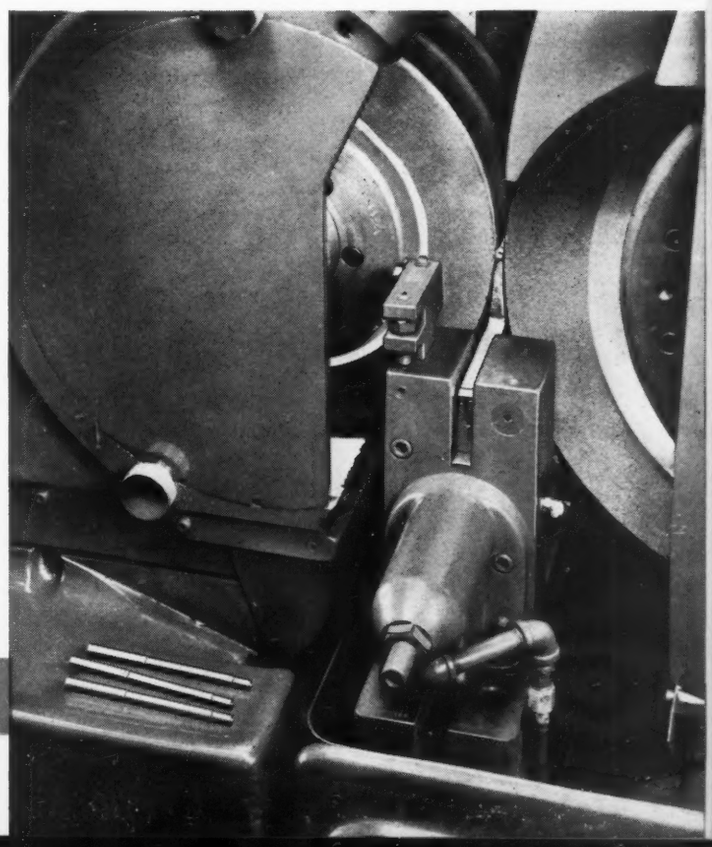


Fig. 3. Five diameters on the shafts seen at the lower left are ground simultaneously by the in-feed method using a profile grinding wheel, three spaced regulating wheels, and a stepped work-rest blade

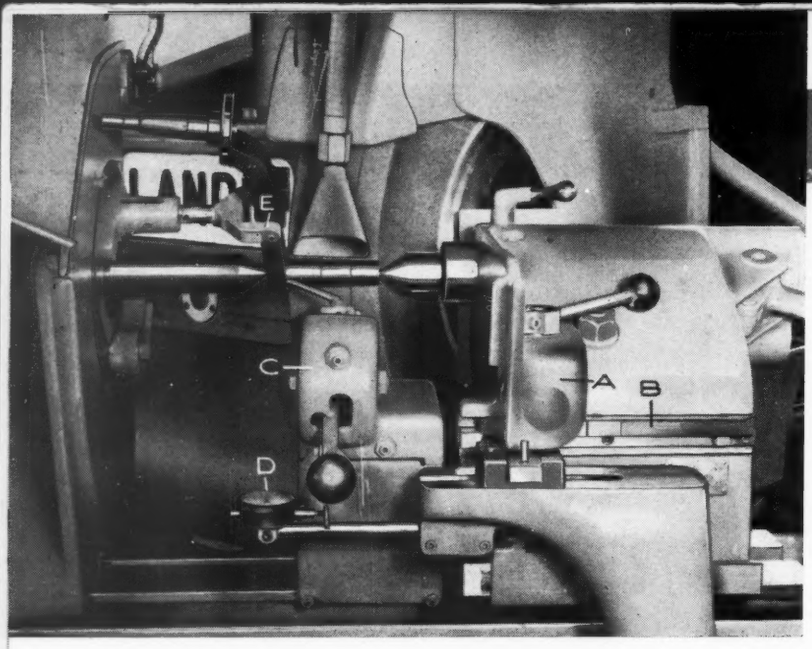


Fig. 4. A profile grinding wheel, mounted on a wheel-base set at an angle of 40 degrees with center line of work, is used to simultaneously grind three diameters on the part shown

on the grinding wheel is controlled by profile bar *B*, which is locked to the bed of the machine during the dressing operation. The diamond is mounted on the end of a spring-loaded bar that is fitted into the footstock. As the diamond is traversed back and forth across the wheel, a follower mounted on the diamond bar will trace the pattern of the profile bar.

A locating device *C*, which has a projecting finger that contacts the work-piece, is employed for positioning the work-table with relation to the grinding wheel. This device, used in conjunction with dial indicator *D*, insures correct location of the work during hydraulic rapid infeed. An extra long headstock center and a special footstock center, which is ground away to provide clearance for the wheel, are required for this operation. The work is rotated by means of yoke clamp *E*, which is secured to the faceplate of the machine.

Finishing Several Surfaces Simultaneously by Multiple-Wheel Grinding

Multiple-wheel grinding is another method of finishing several diameters in one operation on plain cylindrical grinding machines. Three diameters on a shaft are being ground on the 4-inch plain hydraulic grinder seen in Fig. 5. The shafts are finished on a production basis, holding the smallest diameter within 0.0003 inch of the desired size. The properly spaced grinding wheels are dressed with relation to each other by means of a profile bar mounted on the wheel-dressing device.

The grinding-wheel base on this machine is equipped with hydraulic rapid advance, slow grinding feed, and timing for spark-out. Because of the rapid advance, it is essential that the work be accurately located with relation to the grinding wheels. For this purpose, a table type, lateral locator, similar to the one described in reference to Fig. 4, is used in conjunction with a dial indicator mounted on the bed of the machine.

Flexibility of such standard machines permits the grinding of various jobs on a production basis with only simple changes in tooling. When it is desired to grind a different part, it is only

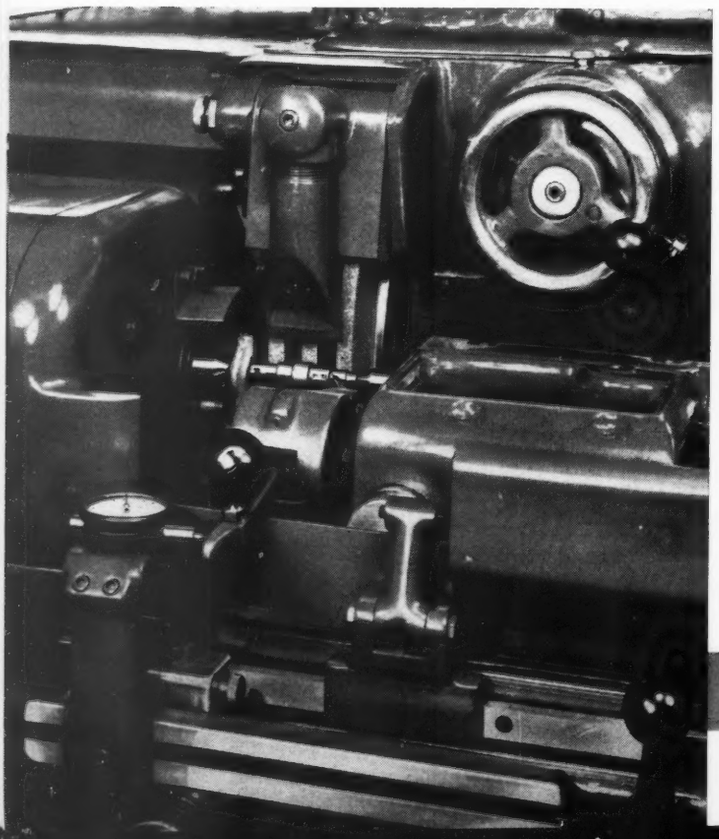


Fig. 5. Three grinding wheels, accurately spaced on a common spindle, are employed to finish three surfaces on a shaft in one operation. Tolerance on the smallest diameter is 0.0003 inch

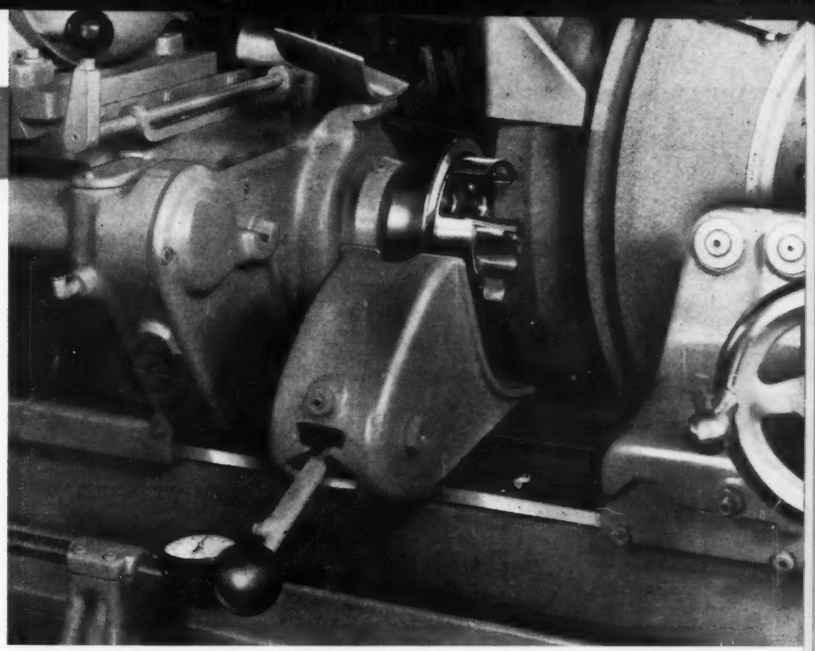


Fig. 6. Two diameters, three faces, and a fillet on planet-gear carriers are ground in two operations in this multiple-wheel set-up on a plain cylindrical grinding machine

necessary to replace the spaced grinding-wheel assembly and the profile bar on the wheel-truing device.

Three grinding wheels, mounted on a wheelbase that is set at an angle of 30 degrees with the center line of the work, are employed to finish various surfaces on a planet-gear carrier, as shown in Fig. 6. The first grinding operation, which is seen in the illustration, consists of simultaneously finishing the interrupted diameter of the part, the adjacent face, and the connecting fillet by means of the left-hand wheel. The wheelbase is then retracted, the headstock and work are moved to the right, and the wheels are again brought forward. In the second operation, both front and back faces of the planet-gear carrier, as well as its narrow pilot diameter, are ground at the same time by the two wheels at the right.

Two table type diamond dressers are employed to true the wheels. Two diamonds are mounted on the dresser seen at the right, for dressing the peripheries of the left-hand and center wheels simultaneously. The periphery on the right-hand wheel need not be dressed since only one side of this wheel is used for grinding. The second dresser, not visible, is actuated by the handwheel seen at the right to dress the sides of all three wheels. The work is mechanically clamped on an arbor, which is held in a cat-head chuck that is adjustable radially by means of set-screws. Carriage stops are used for positioning both the work and the dressers to speed production.

Grinding Odd-Shaped Parts

Odd-shaped parts can often be accommodated on plain cylindrical grinders by designing special work-holding fixtures. Such a fixture is seen in Fig. 7, loaded with a double-knuckle for a tractor axle that has been finish-ground. Counterweights *A* are provided on the faceplate of the live-spindle headstock to offset the centrifugal force created by rotating heavy fixture *B* and the work. A quick-acting nut *C* is provided for

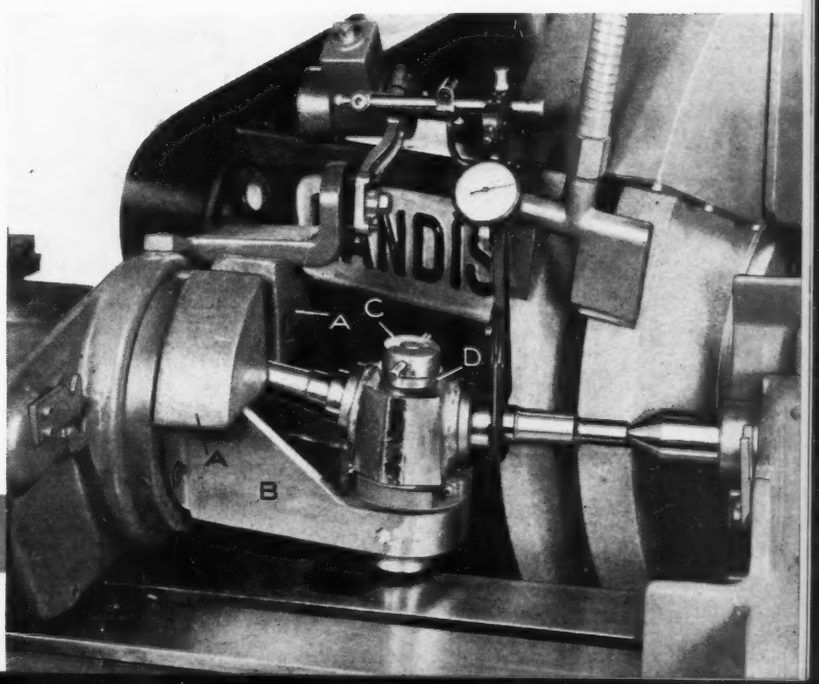


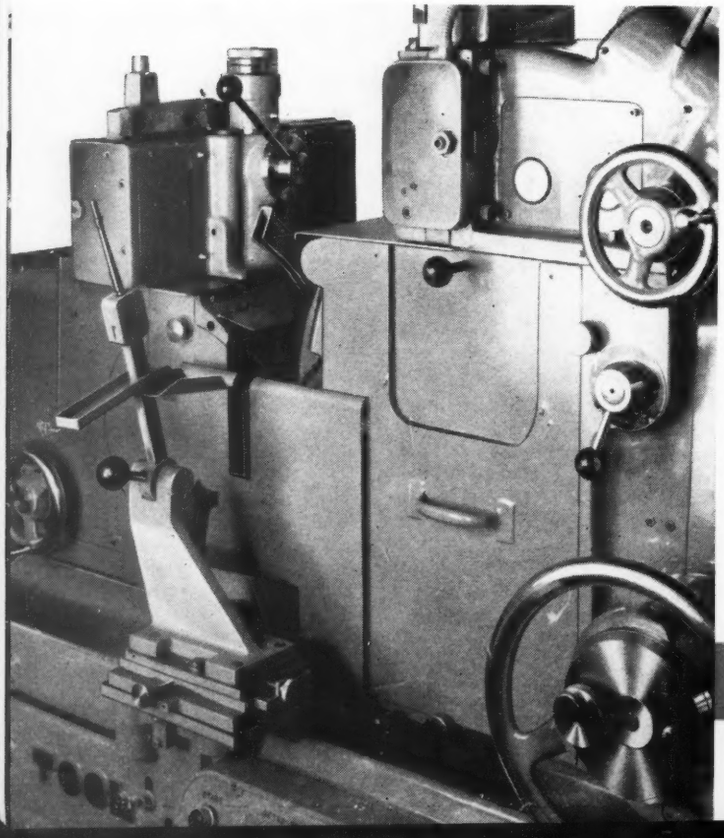
Fig. 7. Special work-holding fixture, mounted on the live-spindle headstock of a plain cylindrical grinding machine, for finishing six diameters and six faces on tractor-axle double-knuckles

Fig. 8. Six automatic free-wheeling cams are mounted on a single arbor of this cam grinder for finishing two cams at a time. Automatic dressing and compensating wheel in-feed are provided

clamping the work in position after it has been slipped over arbor *D*.

Two grinding wheels, 30 inches in diameter and spaced 1 1/2 inches apart, are mounted on a spindle set at a 30-degree angle. The first operation consists of grinding two concentric diameters and two parallel shoulders at the same time. The work-piece is turned end for end, and the same operation is repeated on the opposite end of the double-knuckle. In the third operation, only the left-hand wheel is used to grind a third diameter and its adjoining shoulders. The fourth operation is the same except that the work is again turned end for end. Hydraulic rapid infeed is provided for the grinding-wheel base to speed the grinding cycle.

An Arnold automatic dial indicating gage mounted on the headstock body is used for sizing. An extra caliper frame of larger size is substituted for the one shown when performing the third and fourth operations. A profile type wheel-truing device, built into the footstock base and operated from profile bars mounted on the bed casting, is used to dress the peripheries of the grinding wheels. A table-mounted, right-angle wheel dresser is employed to true the sides of the wheels.



Finishing Cam Contours on Plain or Special Grinders

Cam contours can be finished on plain cylindrical grinding machines equipped with a cam-grinding attachment or on regular cam grinders.

Fig. 9. A combination of diamond-dressing and wheel-crushing is employed on this centerless grinder to secure a fine finish on irregular-shaped automotive transmission control levers in preparation for chromium-plating

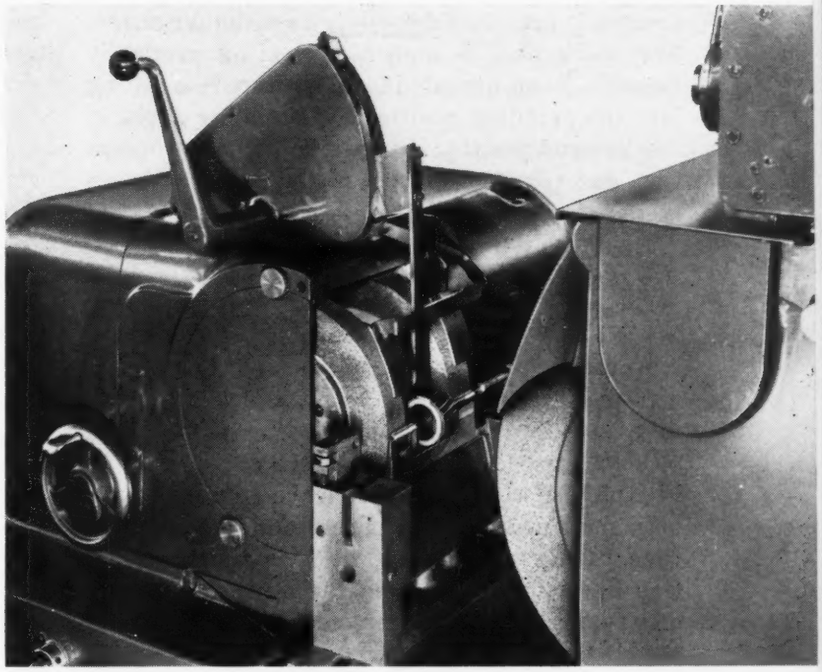


Fig. 10. Hand-operated mechanical loading device, mounted above the regulating wheel of a centerless grinding machine, is employed to lower electrical motor armatures into the grinding position

On the latter machines, both the footstock and headstock spindles are mounted on a cradle, which rocks back and forth in relation to the grinding wheel by the action of a master cam contained in the headstock mechanism.

Free-wheeling cams are seen being ground on a 5-inch cam grinder in Fig. 8. Six cams are placed on the arbor, and two cams are ground at the same time. Splines in the bores of the cams slide in keyways provided on the arbor. Care must be exercised in properly positioning the work on the arbor so that the cams will be correctly located with relation to the work-driving dog and the master cam mounted in the headstock mechanism.

Automatically, at the completion of each grinding cycle for two cams, the wheel-base retracts and the carriage indexes to the next pair of cams by means of the hydraulic system on the machine. A hydraulically operated wheel-dressing device is mounted on top of the wheel-base. This dresser is provided with automatic feed to remove a predetermined amount from the periphery of the wheel at the completion of each cycle. A corresponding amount of in-feed is automatically made on the wheel-base so that no hand adjustments are required for consecutive grinding cycles to maintain sizes.

Combination diamond-dressing and wheel-crushing of the grinding wheel is employed in the set-up seen in Fig. 9 to secure a fine finish on irregular-shaped, automotive transmission control levers. The wheel is first dressed to shape with the diamond, and then the crusher is used to smooth out the diamond marks in the wheel. This combination dressing and crushing of the grinding wheel is an excellent method of producing a wheel surface that will provide a smooth surface finish on machined parts that are to be subsequently plated.

The machine employed for plunge form-grinding of the transmission control levers is a centerless thread grinder equipped with a profile dresser on the regulating wheel base and a mechanical loader. The work-pieces come to the machine in an unhardened, form-turned condition. A suitable finish is desired on the irregular shape so that the shafts will be ready for chromium-plating without extra polishing operations.

The built-in wheel crushing and forming device is located in the grinding-wheel base. A hydraulically controlled diamond, guided by a profile bar mounted on this device, is traversed over the wheel. A graduated handwheel provides means for forcing the formed, hardened steel crushing roller a definite amount against the 4-inch wide grinding-wheel face. In forming the regulating wheel, a hydraulically operated profile

dresser is used to diamond-dress a similar shape. The work-piece is shown projecting vertically from the hand-operated loader before it is swung into the grinding position. The loader stays in the lowered position during the grinding operation, and returns the work to the position shown at the completion of the cycle.

Loading Devices Speed Up Grinding Production

Another good example of a simple hand-operated mechanical loading device, which is applied to a standard centerless grinding machine to produce a specialized work-piece, is seen in Fig. 10. The work is an electrical motor armature, both shaft ends of which are ground at the same time. The part is lowered into the grinding position by manually rotating the operating handle on the mechanical loader, seen mounted above the regulating wheel. The path through which the armature moves during loading and unloading is approximately concentric with the regulating wheels. Two grinding wheels, 2 3/8 and 2 inches wide; two regulating wheels, each 2 inches wide; and two work-support blades are properly spaced to accommodate the large-diameter rotor.

This is an in-feed plunge grinding operation, and the regulating wheel base is tilted slightly in order to keep the part against stops mounted on the work-rests. Approximately 0.005 inch of stock is removed from each diameter during rough-grinding, and 0.002 inch in finish-grinding. Rough-grinding is performed at the rate of 100 parts per hour, while 150 parts are produced per hour in finish-grinding. Shaft diameters are held within 0.0005 inch of the desired size. To change to conventional through-feed or in-feed grinding operations, it is only necessary to remove the work loader and substitute suitable grinding and regulating wheels.

Determining Radial Clearance on Thread Milling Cutters without Lead

By SHERWOOD C. BLISS

THE writer recently investigated a case where torn threads were produced in the milling of a screw having eighteen threads per inch with a cutter that had been designed and made in the shop. The cutter was of the multiple-thread type without lead. As a result of insufficient radial clearance, there was a dragging effect on the sides of the thread helix which caused tearing of the metal.

This trouble was similar to that which had been encountered some years ago when cutting buttress threads on a lathe with a straight form-ground threading tool like the one shown in Fig. 1. At that time, a formula was developed for determining the end angle *C*, Fig. 2, which would result in that side of the threading tool which was rubbing on the side of the thread helix being tangent to the surface of the thread helix. The tool shown in Fig. 1 was then ground with a clearance of about 3 degrees greater than the calculated value for *C*. This eliminated the rubbing and a satisfactory cutting action resulted.

In the case of the thread milling cutter, which was for an American Standard thread, a similar procedure eliminated the torn threads. Fig. 2 illustrates the method used for deriving the formula for the clearance angle. Although a single-point threading tool is shown, the formula, which is based upon the theory of limiting values, applies with equal accuracy to so-called multiple-thread type milling cutters.

The line *y–y*, Fig. 2, is a section of the thread helix at the arc *x–x*. As the radius of the arc

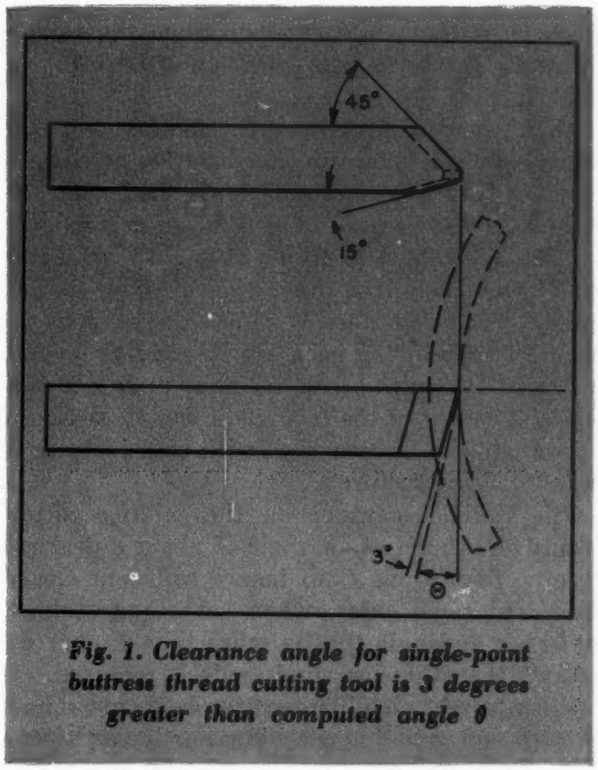


Fig. 1. Clearance angle for single-point buttress thread cutting tool is 3 degrees greater than computed angle θ

x–x becomes smaller and smaller—in other words, as it approaches the radius $\frac{D}{2}$, which is the radius of the root diameter of the thread—the following relationships become true:

Let A = the arc subtended by the tool, as shown in the diagram Fig. 2;

F = one-half of the thread angle (or the smaller of the two side angles in the case of buttress or drunken threads);

H = the lead angle of the thread helix at the root diameter of the thread;

L = the lead of the thread;

D = the root diameter of the thread.

Then it can be seen that

$$B = A \tan C \tan F \quad (1)$$

$$B = A \tan H \quad (2)$$

Therefore

$$A \tan C \tan F = A \tan H \quad (3a)$$

or

$$\tan C = \frac{\tan H}{\tan F} \quad (3b)$$

But

$$\tan H = \frac{L}{\pi D} \quad (4)$$

Hence

$$\tan C = \frac{L}{\pi D \tan F} \quad (5)$$

In the case of a formed thread milling cutter, the radial relief on each tooth may be expressed either as an angle or as the difference between the outside radius R_1 at the face and the outside radius R_2 at the heel of the tooth, as shown in somewhat exaggerated form in Fig. 3. It might also be expressed as the amount of radial relief

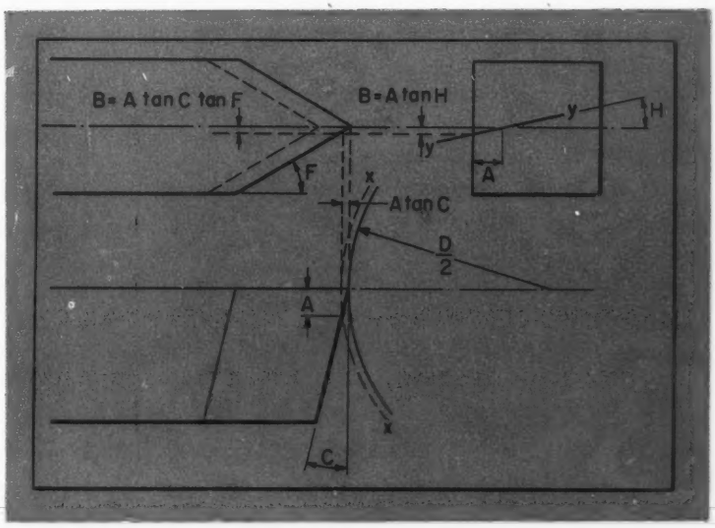


Fig. 2. Diagram showing relationships between thread half-angle (F), helix angle (H), and end angle (C) for a single-point threading tool

per inch of distance along the circumference of the cutter.

To find the amount of radial relief for a multiple-thread cutter, the suggested 3 degrees is added to angle C. The tangent of the resulting angle will then be the required radial relief per unit length of the circumference.

For example, suppose it is required to find the amount of radial relief for a multiple-thread formed milling cutter which is to cut a 1 1/2 inch–12 American Standard Fine Thread. Then $F = 30$ degrees; $D = 1.3917$ inches; and $L = 0.0833$ inch.

$$\tan C = \frac{L}{\pi D \tan F} \qquad (5)$$

$$\tan C = \frac{0.0833}{3.1416 \times 1.3917 \times 0.57735}$$

$$\tan C = 0.03301$$

$C = 1$ degree 54 minutes, say 2 degrees

$C + 3$ degrees $= 5$ degrees

tan 5 degrees $= 0.0875$

Hence, the radial relief should be 0.0875 inch per inch of circumference of the cutter. If the circumferential distance from face to heel of each cutter tooth is 0.420 inch, then the radial clearance per tooth will be $0.420 \times 0.0875 = 0.037$ inch.

As a practical procedure for finding angle C graphically, the diagram shown in Fig. 4 is convenient. The root circumference of the thread is laid out as the base of a right-angle triangle and the hypotenuse is drawn at angle F with the base. Obviously, the other side is equal to the thread root circumference times the tangent of angle F. Measuring back a distance L from the vertex of the right angle, a line is drawn to the opposite corner of the triangle, forming angle C. This angle can be measured with sufficient accuracy by a protractor.

The radial clearance on the milling cutter should be ground at an angle of about 3 degrees greater than angle C to insure sufficient clearance. In some cases, when threading stringy material, an angle that is more than 3 degrees greater than the computed angle is required.

When a thread milling cutter is form-ground on a thread grinding machine, particular attention should be paid to the spacing of the cutter teeth. If the teeth are spaced too closely, the grinding wheel may interfere with an adjacent tooth when grinding the radial clearance.

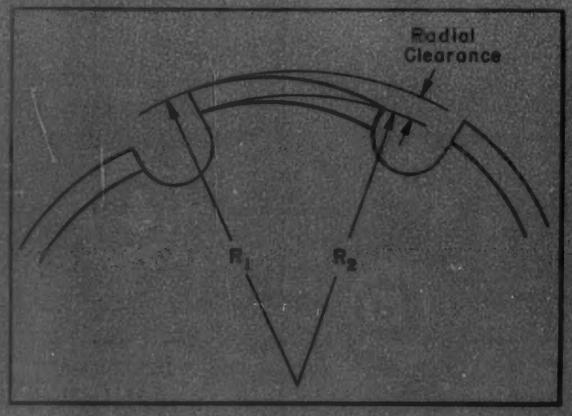


Fig. 3. (Below) Radial relief or clearance is here shown as difference between radii (R_1) and (R_2)

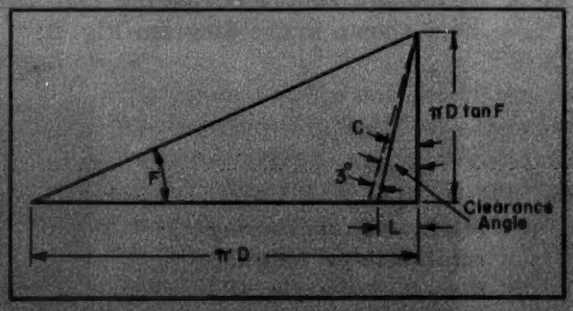


Fig. 4. (Above) Graphical method of computing angle (C) when angle (F), root diameter (D), and lead (L) are known

A Bill for Greater Depreciation Reaches Congress

THE vital need for a greater allowance for depreciation of manufacturing equipment in the income-tax regulations of the Federal Government has been stressed time and again by the technical press, by builders and buyers of manufacturing equipment, and by economists who fully understand the importance of high productivity in the maintenance of a healthy economy. Hope for a change in these tax regulations has been inspired by the introduction of a bill in the House of Representatives. The bill was sponsored by Congressman Wright Patman of Texas, and the occasion was July 20.

This bill, designed to "provide specific measures in furtherance of the national policy of maximum employment, production, and purchasing power, as established in the Employment Act of 1946," has been designated H.R. 5696.

The important feature of this bill as far as industry is concerned is that it provides for the amortization of manufacturing equipment over any period that a taxpayer elects of not less than sixty months. In other words, a machine tool or any other type of production machinery could be amortized in five years' time, whereas under present regulations, the period for the write-off of machine tools is from fifteen to twenty-five years. With the current regulations, machine tools are frequently worn out or obsolete before they have been amortized.

In the words of Congressman Patman, his bill is for the purpose "of maintaining high investment, production, and employment, and encouraging their sustained expansion." As pointed out on this page in August MACHINERY, the time for a revision of depreciation regulations is right now, because with customers becoming more and more price conscious, the need for cost reduction is imperative.

Congressman Patman's bill would also create a bipartisan commission to examine federal, state, and local tax structures and policies with a view to determining to what extent these structures and policies are a deterrent to sustained economic expansion. The commission would recommend appropriate incentives for needed expansion of private investment and consumer purchasing power.

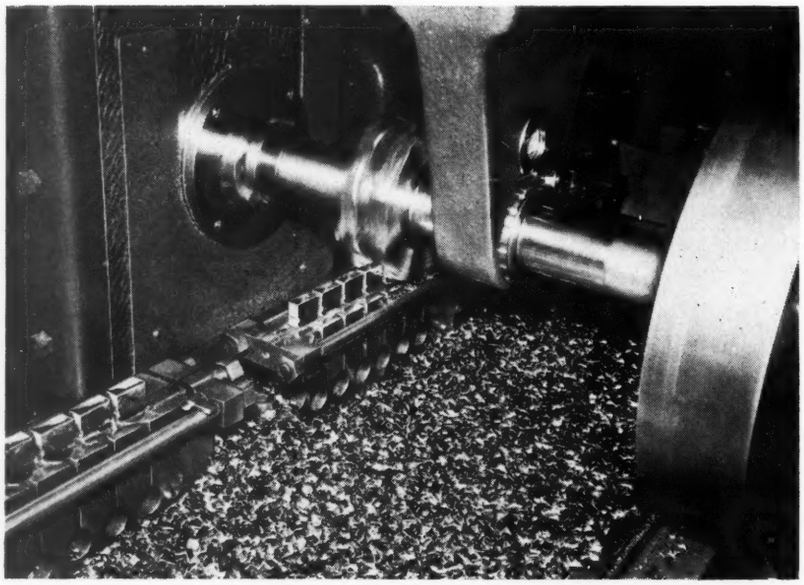
Incongruous as it may seem, the same bill provides for more extended compensation to the unemployed. There will undoubtedly be some who will be favorable to greater unemployment compensation and no change in depreciation policies. Too bad that the depreciation question has not been brought up on its own merits, so that a clear-cut Congressional decision could be reached. Then, again, with the present Congress log-jammed with legislative matters, there may be no action on the bill during this session.

However, the bill is tangible evidence that Congressional leaders are beginning to realize the urgent necessity of remedial legislation with regard to the amortization of capital equipment. Those to whom the matter is highly important now have the opportunity for constructive action to assure passage of such legislation.

Charles O. Herb

EDITOR

How to Estimate Milling Costs



Third in a Series of Articles on Estimating Machining Costs in the Job Shop Covering All the Basic Types of Machine Tools

THIS article will describe the procedure for applying an estimating plan to horizontal milling jobs. Estimating costs for milling operations are considerably more complex than those for either the planer or shaper because, in addition to variations in materials, such as hardness, and other considerations, the size and type of cutters used determine the speeds and feeds to a considerable extent.

In two previous articles, proper cutter grinding was emphasized as being highly important in attaining efficient machine tool operations. The sharpening of tool bits is comparatively simple relative to cutter grinding. In many instances, insufficient attention is devoted to the use of proper cutter angles for roughing and finishing, resulting in burned cutters and low production.

Where studies have been made as to proper clearance angles, exceptionally good results have been accomplished. In an article on "High-Speed Planing with Carbide Tools," published in August, 1948, MACHINERY, W. P. Coomey describes the planing of semi-steel castings at speeds of 300 feet per minute with feeds up to 1/8 inch and depths of cut up to 1 inch. These results were largely attained by the use of proper cutter clearance angles.

As a general rule, the clearance angles on the teeth of plain milling cutters should be 4 degrees for cutters larger than 3 inches in diameter and 6 degrees for those under 3 inches. The land at the top of the teeth should be from 0.020 to 0.040 inch wide before clearance is ground.

In the case of small-diameter end-mills and similar cutters, clearance angles greater than 6 degrees will frequently be necessary to insure the back corner of the sharpened land being lower than the cutting edge. The clearance angle at the end teeth of end-mills should be about 4 degrees, and it is well to hollow-grind the teeth slightly, so that the center is 0.001 or 0.002 inch lower than the outside, preventing the inner ends from dragging. If the clearance is too great, vibration is likely to occur, which by all means should be prevented.

It is of particular importance that face mills have the proper clearance at the ends of the teeth. The clearance should be such that the cutting is done on the outside diameter of the cutter and there is no drag on the inside of the teeth on the face of the cutter.

The speeds and feeds shown in the accompanying charts can, in most instances, be exceeded, particularly on large milling machines which have great sturdiness and rigidity, although consideration must be given to horsepower requirements. However, investigation will show that the depth of cut does not increase the power required in the same proportion as the width of cut does. When milling with a heavy feed and taking a deep but a comparatively narrow cut, much less power is required for the amount of material removed than when the feed is light and the cut moderately deep but wide. Ordinarily, a light feed on milling machine work is not economical.

Table 1 shows recommended speeds for gen-

in the Job Shop

By HERBERT W. BROWN
Management Consultant

eral-purpose work. On some classes of work they may prove to be somewhat high; however, the speeds is most instances are less than should be expected. If heavy-duty milling machines are used, the feeds should be increased accordingly, and if coolants are used for milling steel, speeds should be increased approximately 20 to 30 per cent.

The most practical method of establishing milling feeds is on a feed per tooth per revolution basis. When this method is used, the feed per minute equals the feed per tooth per revolution multiplied by the number of cutter teeth multiplied by the number of revolutions per minute.

Example—Find the feed per minute and the speed for a 6-inch diameter high-speed steel face mill having 12 teeth when rough-milling soft cast iron. Assume a depth of cut of 3/16 inch and a feed per tooth of 0.006 inch.

Table 1 shows that the cutter should have a speed of 60 feet per minute. Dividing 60 by the circumference of the cutter in feet to obtain the revolutions per minute we get: $60 \div 1.57 = 38$ R.P.M. Then multiply the number of cutter teeth by the number of revolutions per minute and multiply this product by the feed per tooth to obtain the feed in inches per minute. Thus, $12 \times 38 \times 0.006 = 2.7$ inches feed per minute. This corresponds closely to the feed of 2.5 inches given in Table 3 for a 6-inch diameter high-speed steel milling cutter.

As previously stated, the feeds set forth in the charts are intentionally low, since they must cover a wide range of equipment in various plants. These articles are intended to establish a basic pattern for setting up an estimating system rather than to attempt to prescribe for the many variables found in machining practices. Anyone using the charts will necessarily have to consider the facilities and equipment available in his own shop and should set up charts suitable to his own particular operating conditions.

In setting up Tables 3 and 4, the speeds and feeds given are based on the material to be milled. However, such tables can be set up for the use of a given type of cutter instead of a particular material, in which case, the columns where the type of cutter is given would be replaced with columns showing the materials to be milled, such as cast iron, machinery steel, etc. The heading would then indicate the type of cutter to which the table applies. Either method will prove satisfactory.

The feeds for cemented-carbide cutters given in Table 4 are considerably lighter than normally recommended for this material, because of considerations of horsepower requirements and milling machine construction. Many shops have milling machines that do not have speeds as fast as those ordinarily used for carbide cutters. Therefore, in setting up charts for such shops, it is desirable to use the heaviest possible feeds practical with the equipment available.

Table 1. Milling Speeds, in Feet Per Minute, for Various Materials and Types of Cutters

Material	Carbon Steel Cutters		High-Speed Steel Cutters		Stellite Cutters		Carbide Cutters	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Cast Iron								
Soft	40	50	60	80	90	110	200	300
Medium	25	30	50	60	50	70	150	250
Hard	15	20	30	40	35	45	100	200
Malleable	50	60	80	100	100	125	200	300
Steel*								
Machinery, Soft	50	60	60	80	90	125	150	200
Cold-Rolled, Low-Carbon	40	50	60	80	80	100	150	200
Alloy, Free-Machining	30	40	50	60	60	80	125	175
Alloy, Tough-Machining	20	30	40	60	50	70	100	125
Annealed Tool Steel	20	30	40	60	50	70	100	125
Annealed Chrome Nickel	20	30	30	40	40	50	75	125
Steel Castings	30	35	45	60	50	70	100	200
Non-Ferrous Metals								
Brass, Yellow	75	90	100	150	150	200	250	350
Bronze, Regular	40	50	60	70	80	100	200	300
Bronze, Manganese	30	40	50	70	60	70	100	200
Aluminum	400	500	600	800	900	1200	1000	1500

*When coolant is used, speeds may be increased from 20 to 30 per cent for carbon steel, high-speed steel, and Stellite cutters.

Table 2. Feeds in Inch Per Tooth Per Cutter Revolution*

Material to be Milled	Depth of Cut, Inch		
	1/8 to 3/16	1/16 to 1/8	1/32 to 1/16
Cast Iron	0.005 to 0.008	0.006 to 0.010	0.004 to 0.008
Malleable Iron	0.005 to 0.008	0.006 to 0.010	0.004 to 0.008
Brass, Yellow	0.008 to 0.012	0.010 to 0.015	0.006 to 0.010
Aluminum ...	0.003 to 0.006	0.004 to 0.006	0.003 to 0.005
Bronze	0.006 to 0.010	0.008 to 0.012	0.006 to 0.010
Steel	0.003 to 0.006	0.004 to 0.008	0.003 to 0.006

*These figures are applicable to all types of milling cutters.

In most milling operations, the table travel exceeds the length of the milled dimension. This over-run must be calculated and a time allowance made for it. Table 5 gives the amounts to be added to the length of cut to obtain the total table travel required for various cutter diameters and depths of cut. For example, when using a 6-inch cutter with a 1/4-inch depth of cut, 1 1/4 inches must be added to the actual length of cut on the work to get the total table travel. The figures in this table are given to the closest fraction of an inch, and may be used as presented.

The milling time chart, Table 6, gives the time required for various lengths of cut at different feeds. It does not cover feeds for all milling machines, but rather presents a typical range of feeds. In using this chart, it is first necessary to determine the most practical feed to be used for milling a certain job. The more familiar the estimator becomes with estimating milling work, the more readily will he be able to select the feeds to be used. Tables 3 and 4 are referred to in determining the proper feed to be used, and when applied in conjunction with Table 6 will provide the time per cut for a given job.

The time factors given in this table are determined by dividing the length of cut in inches by the feed in inches per minute. To this must be added an allowance for delays. For planer and

Table 3. Speeds and Feeds for Milling Cast Iron on Machines of Light Construction

Type of Cutter	Depth of Cut, Inch	Speed, Feet per Minute	Feed, Inches per Minute (Carbon Steel Cutters)						Speed, Feet per Minute	Feed, Inches per Minute (High-Speed Steel Cutters)					
			2-inch Diameter	4-inch Diameter	6-inch Diameter	8-inch Diameter	10-inch Diameter	12-inch Diameter		2-inch Diameter	4-inch Diameter	6-inch Diameter	8-inch Diameter	10-inch Diameter	12-inch Diameter
Face Mills	1/32	50	3.0	3.0	3.0	2.5	2.0	2.0	80	5.0	4.5	4.0	3.5	3.0	3.0
	1/16	50	2.5	2 5	2 5	2.0	1.5	1.5	80	4.5	4 0	3.5	3.0	2.5	2.5
	1/8	45	2.0	2.0	1.5	1.5	1.5	1.0	70	4.0	3.5	3.0	3.0	2.5	2.0
	3/16–1/4	40	2.0	2.0	1.5	1.0	1.0	1.0	60	3.0	3.0	2.5	2.5	2.0	2.0
Spiral Slab Mills	1/32	50	2.5	2.5	2.5	...	...	...	80	4 5	4.0	3.5	...	...	...
	1/16	50	2.5	2.0	2.0	...	...	...	80	3.5	3.0	2.5	...	...	...
	1/8	45	2.0	2.0	1.5	...	...	...	70	3.0	2.5	2.0	...	...	...
	3/16	40	1.5	1.5	1.0	...	...	...	60	2.5	2.0	2.0	...	...	...
Side Mills	1/8	50	2.5	2.5	2.5	...	...	...	80	4.0	4.0	3 5	3.5	...	...
	1/4	45	2.0	2.0	2.0	1.5	...	...	70	3.5	3.0	3.0	3.0	...	...
	1/2	40	1.5	1.5	1.0	1.0	...	...	60	2.5	2.5	3.0	3.0	...	...
	3/4	40	1.0	1.0	0.7	0.5	...	...	50	...	2.0	2.0	2.0	...	...
End-Mills	1/32	50	2.0	2.0	...	...	...	...	80	3.0	4.0	...	...	...	...
	1/16	50	1.5	1.5	...	...	...	...	80	2.5	3.0	...	...	...	...
	1/8	45	1.0	1.0	...	...	...	...	70	2.0	2 5	...	...	...	...
	3/16	40	0.7	0.5	...	...	...	...	60	1.5	1.7	...	...	...	...
Saws 1/32 to 1/16 inch	1/8	50	1.5	1.0	0.7	...	...	...	80	1.5	1.5	1.0	...	...	...
	1/4	40	1.0	0 7	0.5	...	...	...	70	1.0	1.0	0.7	...	...	...
	3/8	30	0.7	0.5	0.5	...	...	...	60	1.0	0.7	0.5	...	...	...
	1/2	20	0.5	0.4	0.3	...	...	...	50	0.7	0.5	0.5	...	...	...
Saws 1/16 to 3/16 inch	1/8	50	1.5	1.0	1.0	...	...	...	80	2 0	2 0	1.5	...	...	...
	1/4	40	1.0	1.0	1.0	...	...	...	80	1.5	1.5	1.0	...	...	...
	3/8	35	0.7	0.7	0.7	...	...	...	70	1.5	1.0	1.0	...	...	...
	1/2	30	0.5	0.5	0.5	...	...	...	60	1.0	1.0	0.7	...	...	...
Form Cutters	All	30	0.7	0.7	...	...	...	...	50	1.5	2.0	...	...	...	...
T-Slot Cutters	1 1/8	40	0.7	...	...	...	...	...	60	1.0	...	...	...	...	...
	2 1/4	40	0.5	...	...	...	...	...	60	0.7	...	...	...	...	...

Table 4. Speeds and Feeds for Milling Machinery Steel on Machines of Light Construction

Type of Cutter	Depth of Cut, Inch	Speed, Feet per Minute	Feed, Inches per Minute (Stellite Cutters)						Speed, Feet per Minute	Feed, Inches per Minute (Cemented-Carbide Cutters)					
			2-inch Diameter	4-inch Diameter	6-inch Diameter	8-inch Diameter	10-inch Diameter	12-inch Diameter		2-inch Diameter	4-inch Diameter	6-inch Diameter	8-inch Diameter	10-inch Diameter	12-inch Diameter
Face Mills	1/32	125	7.5	7.0	6.0	5.0	4.5	4.5	300	15.0	20.0	20.0	20.0	20.0	20.0
	1/16	110	7.0	6.0	5.0	4.5	3.0	3.0	250	12.5	17.5	17.5	17.5	17.5	17.5
	1/8	100	6.0	5.0	4.5	4.5	3.5	3.5	225	....	15.0	15.0	15.0	15.0	15.0
	3/16–1/4	90	4.5	4.5	3.5	3.5	3.0	3.0	200	....	12.5	12.5	12.5	12.5	12.5
Spiral Slab Mills	1/32	125	7.0	6.0	5.0	...	...	...	300	12.5	17.5	17.5	17.5	17.5	17.5
	1/16	110	5.0	4.5	3.5	...	...	...	250	10.0	15.0	15.0	15.0	15.0	15.0
	1/8	100	4.5	3.5	3.0	...	...	..	225	....	12.5	12.5	12.5	12.5	12.5
	3/16	90	3.5	3.0	3.0	...	...	...	200	....	10.0	10.0	10.0	10.0	10.0
Side Mills	1/8	100	6.0	6.0	5.0	5.0	...	...	300	15.0	20.0	20.0	20.0	20.0	20.0
	1/4	90	5.0	5.0	5.0	5.0	...	...	250	12.5	17.5	17.5	17.5	17.5	17.5
	1/2	80	3.5	3.5	4.5	4.5	...	...	225	....	15.0	15.0	15.0	15.0	15.0
	3/4	70	...	3.0	3.0	3.0	...	...	200	....	12.5	12.5	12.5	12.5	12.5
End Mills	1/32	125	4.5	6.0	...	...	...	...	300	15.0	20.0	20.0	....	....	....
	1/16	110	3.5	4.5	...	...	...	...	250	12.5	17.5	17.5	....	....	....
	1/8	100	3.0	2.5	...	...	...	...	225	....	15.0	15.0	....	....	....
	3/16	90	2.5	3.0	...	...	...	...	200	....	12.5	12.5	....	....	....

shaper operation, an allowance of 25 per cent was added to the base time, of which 5 per cent was for tool grinding. In most cases, no allowance is made for cutter grinding on milling work, since normally cutters are sharpened as a separate function, apart from milling machine operation. Also, the setting up of cutters is part of the entire job set-up, and is not usually considered when estimating machine operating time. Consequently, only 20 per cent is added to the base time in the figures given in Table 6.

Example—If the length of cut is 9 inches; the feed 2.5 inches per minute; and the allowance for delays 20 per cent, the time required per cut is calculated as follows:

$$\frac{9.0 \times 1.20}{2.5} = 4.32 \text{ minutes}$$

The charted time required for various lengths of cut as given in Table 6 may be considered to be actual time, since the selection of feeds and lengths of cut determine the cutting time. No adjusting factors are required, as in the case of shaping and planing.

The job planning procedure will determine the number of cuts required to complete a particular milling operation, and the various cuts will be included on the estimating sheet. It is therefore highly important that a detailed analysis be made as a prior step so that the most economical machining methods may be selected and the estimated time calculated on these. The planning of milling work must take into account the necessary cutter changes, if any; these are considered part of the job set-up time.

It may be desirable in setting up milling time

Table 5. Additional Table Travel (Allowances for Cutter Approach in Inches)

Depth of Cut, Inch	Diameter of Cutter, Inches										
	2	3	4	5	6	7	8	9	10	11	12
1/32	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8
1/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1
1/8	1/2	9/16	11/16	3/4	13/16	15/16	1	1 3/32	1 1/8	1 3/16	1 1/4
3/16	5/8	11/16	7/8	13/16	1	1 1/8	1 1/4	1 5/16	1 3/8	1 7/16	1 1/2
1/4	3/4	13/16	1	1 1/8	1 1/4	1 3/8	1 1/2	1 9/16	1 5/8	1 11/16	1 3/4
3/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 13/16	1 7/8	1 15/16	2
1/2	...	...	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 1/2
5/8	...	...	1 5/8	1 3/4	1 7/8	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4
3/4	...	...	1 3/4	1 7/8	2	2 1/4	2 1/2	2 5/8	2 3/4	2 7/8	3

Table 6. Milling Time Chart

Time in Minutes Required for Various Lengths of Cut at Different Rates of Feed

Feed, Inches per Minute	Length of Cut, Inches												
	1/2	1	2	3	4	5	6	7	8	9	10	20	30
1/4	2.4	4.8	9.6	14.4	19.3	24.0	28.8	33.6	38.4	43.2	48.0	96.0	144.0
3/8	1.6	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	64.0	96.0
1/2	1.2	2.4	4.8	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	48.0	72.0
5/8	1.0	2.0	3.9	5.8	7.7	9.6	11.5	13.4	15.3	17.3	19.3	38.5	57.8
3/4	0.8	1.6	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4	16.0	32.0	48.0
7/8	0.7	1.4	2.8	4.1	5.5	6.9	8.2	9.6	11.0	12.3	13.7	27.4	41.1
1	0.6	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	24.0	36.0
1 1/4	0.5	0.95	1.9	2.9	3.9	4.8	5.8	6.7	7.7	8.6	9.6	19.2	28.8
1 1/2	0.4	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	16.0	24.0
1 3/4	0.35	0.7	1.4	2.1	2.8	3.5	4.1	4.8	5.5	6.2	6.9	13.7	20.6
2	0.3	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	12.0	18.0
2 1/2	0.24	0.48	0.96	1.44	1.92	2.4	2.9	3.4	3.9	4.3	4.8	9.6	14.4
2 3/4	0.22	0.44	0.87	1.31	1.75	2.2	2.6	3.1	3.5	3.9	4.4	8.7	13.1
3	0.20	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	8.0	12.0
3 1/2	0.18	0.35	0.69	1.0	1.37	1.72	2.1	2.4	2.75	3.1	3.43	6.85	10.3
4 1/4	0.14	0.28	0.56	0.84	1.13	1.42	1.57	2.0	2.25	2.54	2 82	5.65	8.5
5 1/8	0.12	0.24	0.47	0.71	0.94	1.17	1.40	1.65	1.87	2.11	2.34	4.68	7.0
5 3/4	0.11	0.21	0.42	0 63	0.84	1.05	1.25	1.46	1.67	1.88	2.08	4.16	6.24
6 1/8	0.10	0.2	0.39	0.59	0.78	0 99	1.18	1.37	1.57	1.76	1.96	3.92	5.88
7 1/4	0.09	0.17	0.34	0.50	0.67	0.83	1.0	1.16	1.32	1.49	1.65	3.31	4.96
8 3/4	0.07	0.14	0.28	0.42	0.55	0.69	0.82	0.96	1.10	1 23	1.37	2.74	4.11
9 1/4	0.07	0.13	0.26	0.39	0.52	0.66	0.78	0.91	1.04	1.17	1.30	2.59	3.89
10	0.06	0.12	0.24	0.36	0.48	0.6	0.72	0.84	0.96	1.08	1.2	2.4	3.6
11 3/4	0.06	0.11	0.21	0.31	0.41	0.51	0.61	0.71	0.81	0.92	1.02	2.04	3.06
12 3/8	0.05	0.01	0.2	0.29	0.38	0.47	0.58	0.68	0.78	0.87	0.97	1.94	2.91

Note: In the figures given, the following allowances are included: Delays, 10 per cent; measuring, 5 per cent; and other essential interruptions, 5 per cent, making a total of 20 per cent.

charts to group together certain sizes of milling machines. Then a single chart can be set up for each group, and the most practical average feeds be selected for charting purposes. This will facilitate planning the work and eliminate unnecessary detail when selecting the milling time.

The decision as to how milling work can best be done will, of course, be determined by the type of cutters and milling machines used. This may depend upon the cutters available. If there is a limited range of cutters on hand and it becomes necessary to substitute less efficient types, more time will be required to complete the work, possibly resulting in the loss of competitive position. Proper estimating procedures will readily bring this condition to the attention of management for correction.

All too often shop supervisors are aware of the lack of facilities, but do not have a means of determining the savings made possible by the use of proper tools. Consequently, they are unable to present comparable figures upon which intelligent decisions can be made. It is of vital importance that the cost procedure (whether it is the estimating of costs or the figuring of actual costs) function on a sound and efficient basis if a competitive position is to be maintained. This has special significance during periods of decreasing demand for goods and services.

This series of articles may be used not only to estimate work done under prevailing conditions in a given shop, but also the program may serve as a tool by which management may create increasingly more efficient use of its supervisory personnel and facilities.

The next article will continue the discussion of estimating the costs of milling machine work, and will provide additional data to facilitate the estimating procedure.

* * *

Slide-Rule for Broaching Calculations

A slide-rule type calculator for rapidly determining the force required for broaching cast iron, steel, bronze, aluminum, magnesium, or plastic parts is available from the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. The calculator is applicable either to surface broaches or to round, splined, serrated, and keyway broaches. It can be used for checking the suitability of the broaching machine for any job and the capacities of the machines required.

Differential Screw Design

By DANIEL V. THOMPSON

THE use of a differential screw for very fine adjustment has well known advantages. However, these often seem to be outweighed by the difficulty of obtaining the required perfection in two co-axial threads differing minutely from each other in pitch. It is possible, however, to make up differential screws with effective pitches of only a few thousandths inch from screws of no extraordinary quality, and these can be used for very delicate adjustments of quite heavy members. Such a differential screw is shown in the accompanying illustration.

As shown in this illustration, a movable part of width M is to move a distance of plus or minus d relative to the fixed member, which has a width F. Let the pitch of the coarser threaded section of the screw which passes through the fixed member be designated P_f, and the pitch of the finer threaded section of the screw which passes through the movable member as P_m.

If the coarse-threaded part of the screw is at the extreme left in the fixed member, and the movable member is at the extreme right on the fine-pitch thread, then:

1. For each turn of the screw, the coarse-threaded part of the screw will move to the right a distance of P_f and the movable member will move to the left on the fine-pitch thread a distance of P_m.

2. The movable member will thus have a net movement to the right with relation to the fixed member of $P_f - P_m$.

3. Now if the movable member is to have a total net movement to the right of $2d$, then $\frac{2d}{P_f - P_m}$ turns of the screw will be required.

4. For that number of turns of the screw, the coarse-pitch portion will travel through the fixed member a distance equal to $\frac{2d}{P_f - P_m} \times P_f$; hence, the minimum length of the coarse-pitch section must be $F + \frac{2d}{P_f - P_m} \times P_f$.

5. Similarly, the movable member will travel on the fine-pitch section a distance equal to $\frac{2d}{P_f - P_m} \times P_m$, and the minimum length of that section will be $M + \frac{2d}{P_f - P_m} \times P_m$.

6. If both threaded sections are of minimum length, the maximum distance between the fixed and movable members will be equal to $\frac{2d}{P_f - P_m} \times P_f$, and the minimum distance will be equal to $\frac{2d}{P_f - P_m} \times P_m$.

Example—If the fixed and movable members are each 1 inch wide and a total range of adjustment of 1/8 inch in either direction is required, what will be the minimum length of the coarser thread, if it has 20 threads per inch, and of the finer thread, if it has 32 threads per inch? What will be the pitch of an equivalent thread that will provide the same fineness of adjustment? What will be the minimum and maximum distances between the fixed and movable members?

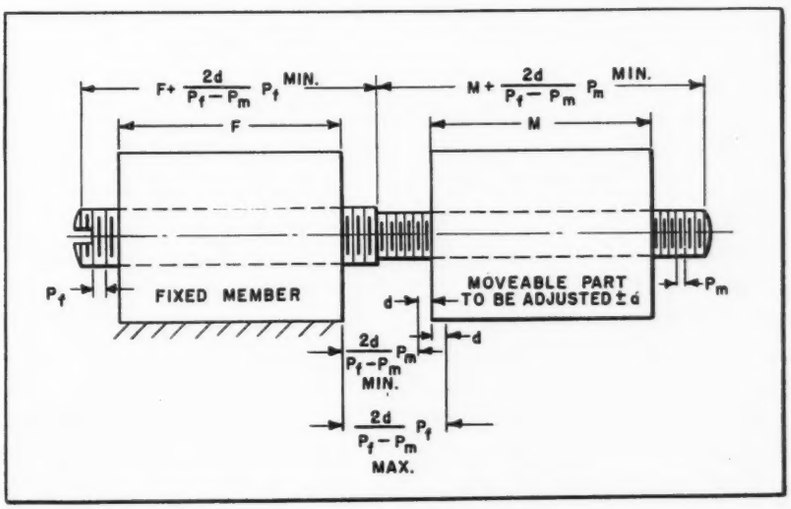


Diagram of differential screw showing formulas for calculating minimum lengths of coarse- and fine-threaded sections

Solution—$F = 1$; $M = 1$; $d = \frac{1}{16} = 0.0625$;

$$P_t = \frac{1}{20} = 0.05; \; P_m = \frac{1}{32} = 0.03125$$

Minimum length of coarse thread =

$$1 + \frac{2 \times 0.0625}{0.05 - 0.03125} \times 0.05$$

$$= 1 + \frac{0.125 \times 0.05}{0.01875} = 1.333 \text{ inches}$$

Minimum length of finer thread =

$$1 + \frac{2 \times 0.0625}{0.05 - 0.03125} \times 0.03125$$

$$= 1 + \frac{0.125 \times 0.03125}{0.01875} = 1.208 \text{ inches}$$

Pitch of equivalent thread =

$0.05 - 0.03125 = 0.01875$ inch

Minimum distance between members = 0.208 inch

Maximum distance between members = 0.333 inch

Cold-Swaging Hexagonal Nuts in a Punch Press

By F. W. HENKE

THE special steel hexagon-head nut shown in Figs. 1 and 2 was originally milled from round bar stock because the distance across the corners of the hexagon head was smaller than the largest diameter of the nut, and consequently hexagonal bar stock could not be used. The operation consisted of straddle milling the hexagonal head on an automatic milling machine after the remainder of the part had been turned.

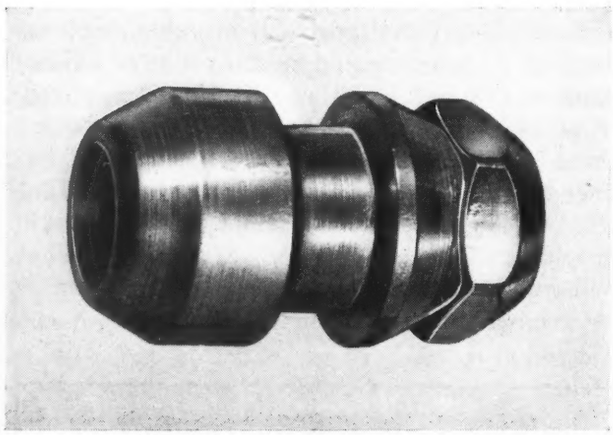


Fig. 1. Special steel hexagon-head nut cold-swaged after turning

Inasmuch as the tolerances were close and the original quantities limited, this method was entirely satisfactory as far as accuracy was concerned, but the rate of production was low. To meet the demand for large quantity production, a method had to be devised for producing the hexagon head accurately at a greatly reduced cost. Furthermore, it was desirable to release the milling machines for more urgently required work.

With the equipment available, cold-heading was impossible. To turn out the parts at the required rate, it was decided that the job should be done on a punch press at one stroke of the ram without annealing the part. This method would normally require a heavy-duty press, which was not available. Consequently, the die shown in Figs. 3 and 4 was designed to cold-swage the hexagon heads in a 3-inch stroke, 35-ton punch press.

Referring to Fig. 3, the housing *A* of the die was cast and bored out to receive a cam ring *B*, which was made of steel plate. The cam surfaces are hardened tool-steel inserts *C*, so mounted as to allow easy replacement. Six slots were milled in the center boss to retain the hardened and

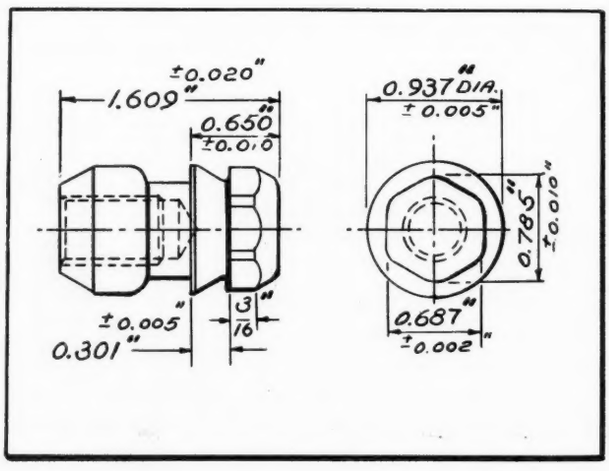
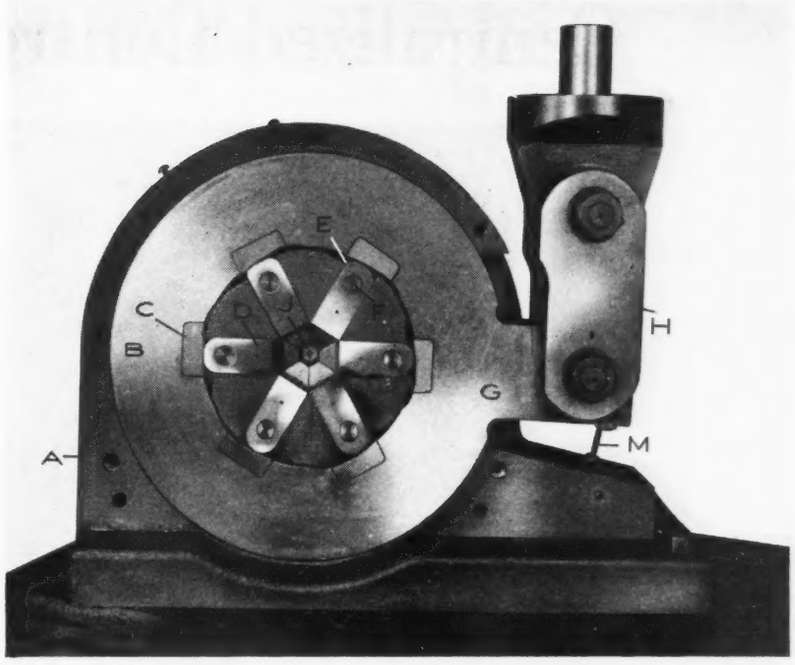


Fig. 2. Dimensions of hexagon-head nut shown in Fig. 1 affected by cold-swaging

Fig. 3. Die designed for cold-swaging hexagonal head on a special nut in a punch press



ground tool-steel movable jaws *D*, which perform the swaging.

In order to reduce friction and wear, a hardened roller *E* was mounted in the back of each jaw. The hardened pin *F* on which the roller revolves extends through the back of the jaw and moves in a slot milled in the casting. Before assembly, a heavy spring which keeps the jaws distended against the cam surfaces was dropped in each slot.

The cam-ring extension *G* is connected to the ram adapter by two heavy links *H*. Thus, the die becomes an integral unit with no loose parts. At the center of the jaws is a knockout pin *J* actuated by a simple trigger arrangement on the back of the die. This pin is normally held back and acts as a stop for the work when it is inserted between the jaws. Forward motion is imparted to pin *J* on the up stroke of the press to eject the part at the end of the operation.

The mechanism is covered by a plate *K*, as shown in Fig. 4, which contains provision for continuous oiling. The hardened bushing *L* in the retaining plate assures the required concentricity between the diameters and the hexagon shape on the nut.

With this die, set-up time is reduced to a minimum because of the fact that it is a single unit. The adapter is secured to the press ram, and the ram is adjusted downward until the two stops *M*, Fig. 3, in the base of the housing and the cam-ring extension meet.

The dimensions shown in Fig. 2 were affected by the cold-swaging, and allowance was made in the turning operation for an increase in length of 0.020 to 0.022 inch.

By the use of this cold-swaging die, one punch press was substituted for two milling machines, production was increased 600 per cent, burring and cutter grinding were eliminated, and a much finer finish was produced on the hexagonal head of the nut, all of which contributed to a large reduction in cost.

The principles incorporated in the design of the die described in the foregoing can be employed to advantage wherever great pressure is required for swaging operations and a press of the necessary tonnage is not available.

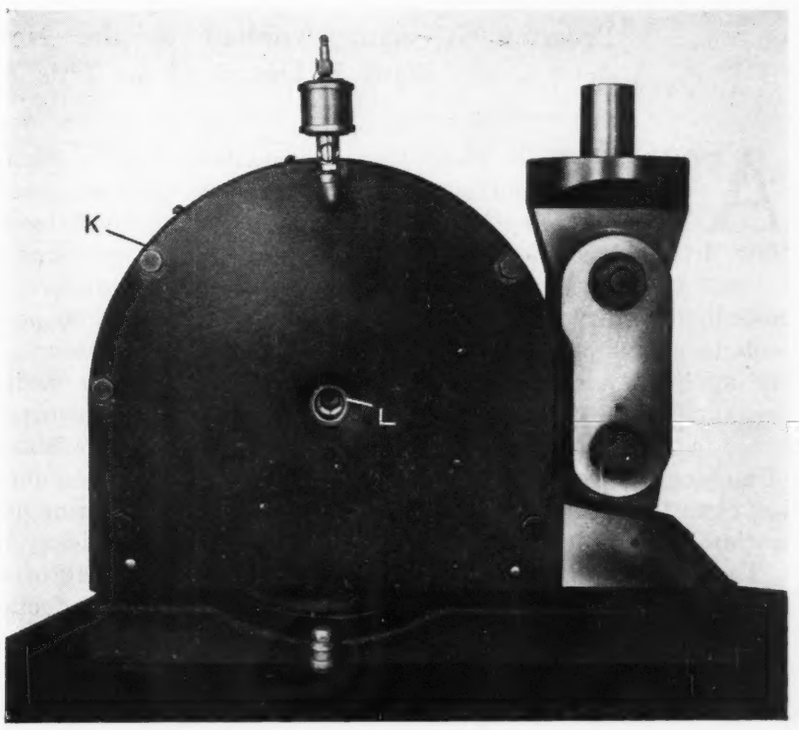
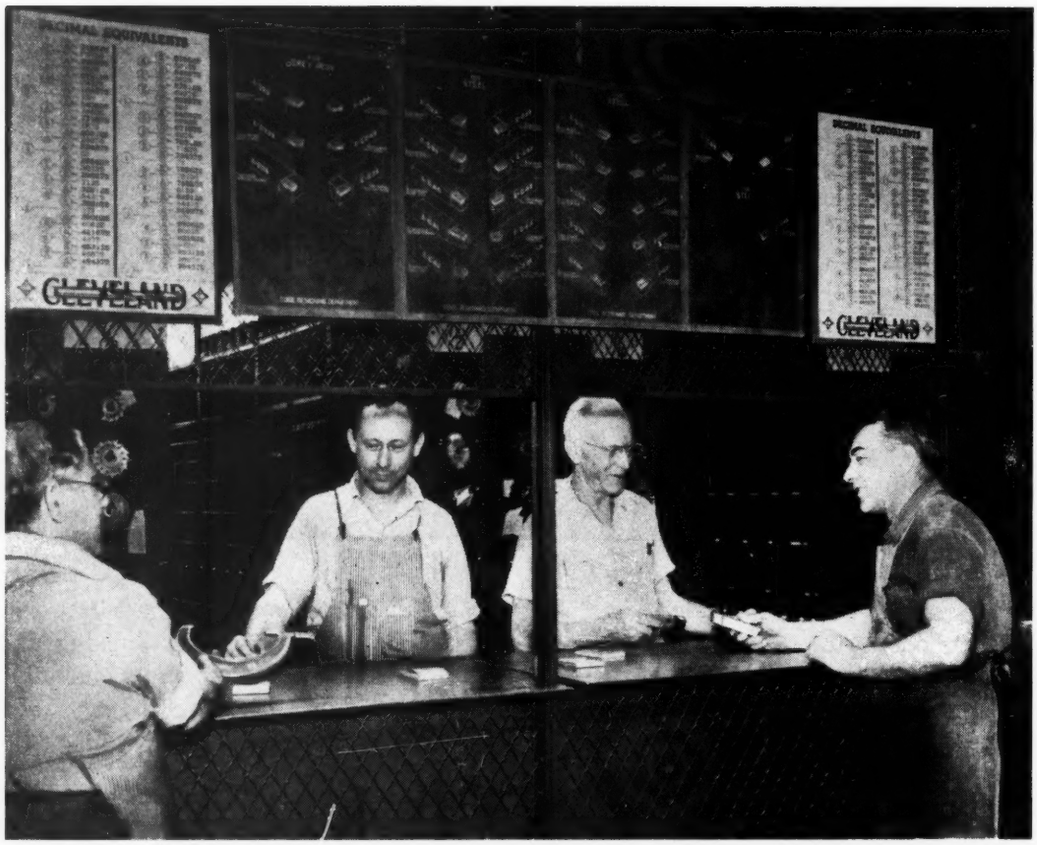


Fig. 4. Cold-swaging die shown with retaining plate (K) and hardened work-locating bushing (L)

Centralized Control of Carbide



A Comprehensive Coordinated Tool Control Program Developed by the Carboloy Company, Inc., has been Made Available to the Metal-Working Industry. How This Type Program is being Applied in the New Britain-Gridley Plant is Described in This Article

ADOPTION of a plant-wide coordinated carbide tool control program at the New Britain-Gridley Machine Division of the New Britain Machine Co., has had several important results. It has decreased new tooling costs by one-third; reduced engineering costs on tools to a minimum; speeded up and simplified the application of tools to jobs; reduced tool breakage by one-third; decreased machine "down time" to an all-time low; improved the operation of an incentive wage scale; and reduced machining costs through wider and more effective utilization of carbide tools.

Tool standardization, coordinated planning and application, centralized grinding, rigid inspection, close inventory controls, and efficient requisitioning practices have all made their contributions to the benefits desired. The coordinated carbide control program was adopted for a two-fold purpose—to keep pace with the latest technical changes in tooling, and to try to offset some of the rising costs of manufacturing.

Standard carbide tools have been applied to about 95 per cent of all single-point machining operations. Special tools, when required, are usually designed to permit the modification of manufacturers' standards or the use of standard carbide blanks. Further, a cataloguing system has been developed that will permit engineers to determine quickly if a special tool of given specifications is available in stock or whether the drawing of such a tool has been made.

Introduction of centralized grinding brought about a one-third drop in tool breakage. The longer life and uniform performance of carbide tools ground at a central point by specially

Tooling Pays Dividends

By BERNARD BLACKER
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trained men have contributed to reducing machine "down time" for tool changes or tool trouble to an all-time low. Incentive wages are more adequately controlled, to the greater satisfaction of both operators and management.

Although carbide tools had been used previously in this plant, no widely coordinated control program had been in effect. The program actually began when the management decided that the benefits resulting from carbide tooling should be more widely applied throughout the plant and the experience of one department made available to another. The first step was the appointment of a carbide coordinator.

One of the first results of the program was the abandonment of conventional lead-angle and straight tool styles for a very large class of work and the replacement of these with a series of offset tools. The new tool types permitted working close to chuck jaws, and facilitated the machining of multi-diameter parts, while retaining all the rigidity of a closely held tool.

Exhaustive tests were made to determine the best combinations of speeds and feeds, depths of cut, carbide grades, and chip-breakers to be used for machining specific materials on the various machine tools in the plant. This information was made available to the various departments—speeds and feeds to the shop supervision personnel and planning departments; standard tool specifications to the tool-crib, grinding room, shop supervision personnel, and purchasing department; design recommendations for special tools to the tool designing department, etc.

Establishment of centralized grinding was also one of the early steps in the coordinated carbide control program. Machine operators previously had requisitioned their tools from the crib and ground them when and as required—each to his own specifications and by his own methods. This resulted in a lack of uniformity, which became apparent in the inability to maintain consistent time standards for a specific operation on any given part.

The grinding of all cutting tools, both high-speed steel and carbide, was centralized at one point, with proper equipment and specially trained personnel. Simultaneously, closer controls were put into effect on tool inventories and on the reporting and investigation of breakage.

Operators now have, at their machines, a group of standard tools that can be used effectively on most routine cuts. When a tool becomes dull, it can be quickly exchanged at the tool-crib for an exact duplicate, eliminating most of the set-up or tool-change time encountered with ordinary practices. The operator is thus working more steadily on actual production.

Realizing that the broadest benefits from the use of carbide tooling and the complete effective-

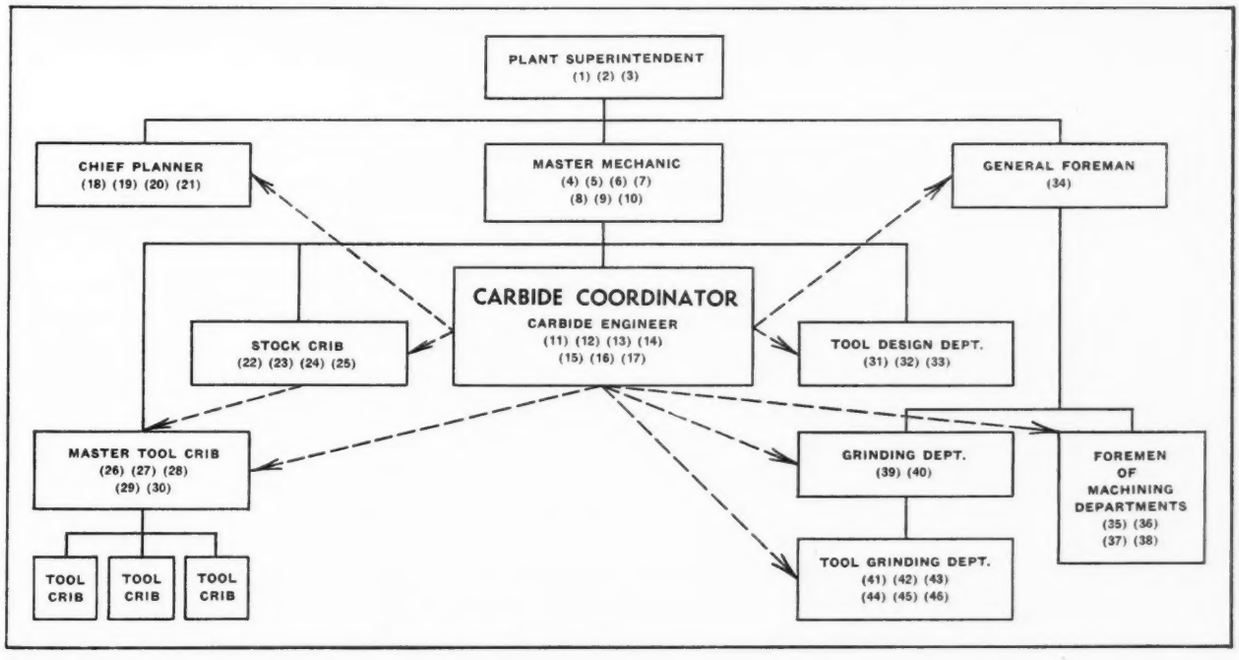


Fig. 1. Organization chart for a typical centralized carbide tooling program. The carbide engineer contacts those departments designated by broken lines in a coordinating capacity

ness of a carbide tooling program can be assured only if there is close relationship between the different departments and individuals concerned with cutting tools, the various individuals in this group at New Britain work together as a team.

The "quarterback" of this team is the carbide engineer, who carries out all the functions of a carbide coordinator. The carbide tooling organization has not supplanted the normal pattern of operating responsibility. Division of major responsibilities related to carbide tooling are shown on the organization chart, Fig. 1. Broken lines extending from the center of the chart lead to those departments contacted by the carbide engineer in a coordinating capacity.

Technically speaking, the carbide engineer has little supervisory responsibility; yet management depends upon him for the smooth operation of its carbide tooling program and for extending as rapidly as possible all its benefits. He has to work closely with many individuals, making recommendations on tooling and procedures, creating and testing ideas, gathering ideas from others, evaluating them, and relaying them through the proper channels.

The carbide engineer, through the master mechanic, is responsible to the plant superintendent. The master mechanic initiates any action relative to new tooling projects requiring an above-normal budget appropriation. In doing so, he relies on the carbide engineer for assistance in formulating that phase of the tooling program related to cutting tool requirements. The carbide engineer is also concerned with the carbide tooling on machines built to order for customers, which are tooled up before leaving

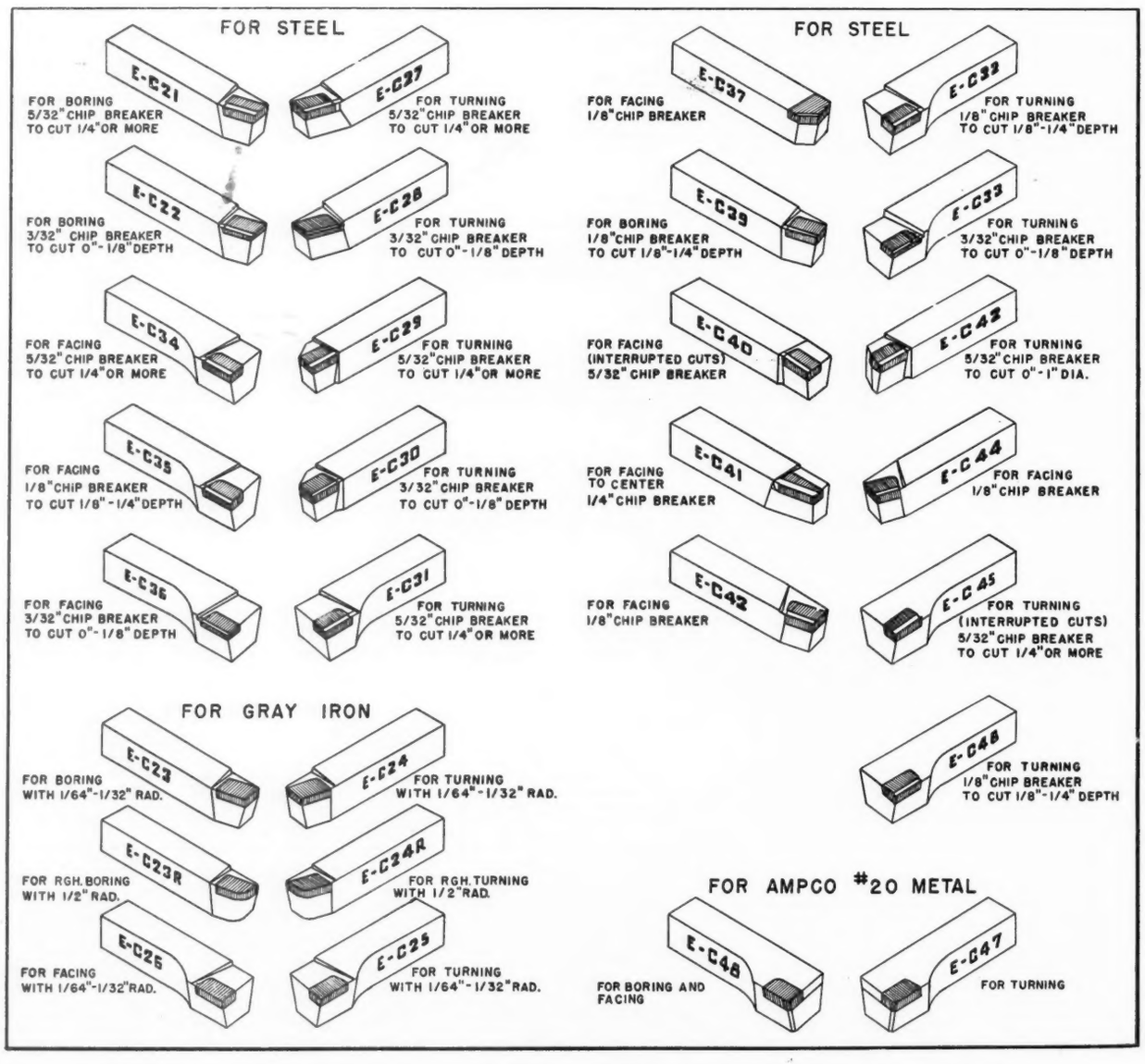
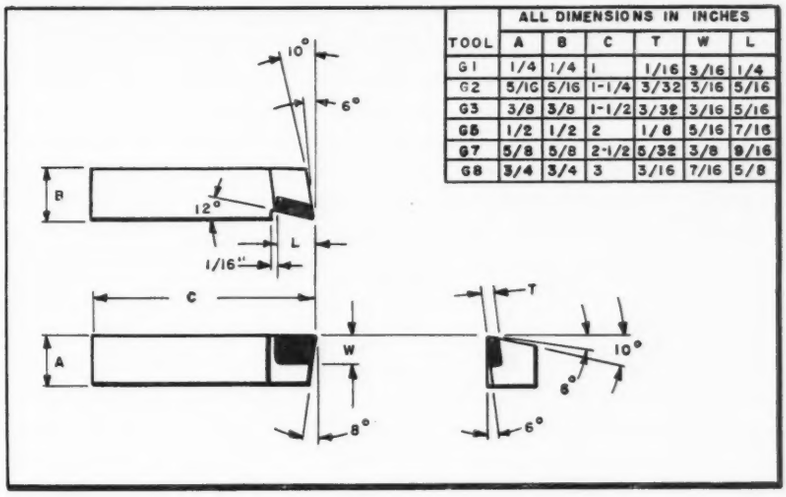

FOR STEEL
E-C21
FOR BORING 5/32" CHIP BREAKER TO CUT 1/4" OR MORE
E-C27
FOR TURNING 5/32" CHIP BREAKER TO CUT 1/4" OR MORE
E-C22
FOR BORING 3/32" CHIP BREAKER TO CUT 0"-1/8" DEPTH
E-C28
FOR TURNING 3/32" CHIP BREAKER TO CUT 0"-1/8" DEPTH
E-C34
FOR FACING 5/32" CHIP BREAKER TO CUT 1/4" OR MORE
E-C29
FOR TURNING 5/32" CHIP BREAKER TO CUT 1/4" OR MORE
E-C35
FOR FACING 1/8" CHIP BREAKER TO CUT 1/8"-1/4" DEPTH
E-C30
FOR TURNING 3/32" CHIP BREAKER TO CUT 0"-1/8" DEPTH
E-C36
FOR FACING 3/32" CHIP BREAKER TO CUT 0"-1/8" DEPTH
E-C31
FOR TURNING 5/32" CHIP BREAKER TO CUT 1/4" OR MORE
FOR GRAY IRON
E-C23
FOR BORING WITH 1/64"-1/32" RAD.
E-C24
FOR TURNING WITH 1/64"-1/32" RAD.
E-C23R
FOR RGH. BORING WITH 1/2" RAD.
E-C24R
FOR RGH. TURNING WITH 1/2" RAD.
E-C25
FOR FACING WITH 1/64"-1/32" RAD.
E-C25
FOR TURNING WITH 1/64"-1/32" RAD.
FOR STEEL
E-C37
FOR FACING 1/8" CHIP BREAKER
E-C32
FOR TURNING 1/8" CHIP BREAKER TO CUT 1/8"-1/4" DEPTH
E-C39
FOR BORING 1/8" CHIP BREAKER TO CUT 1/8"-1/4" DEPTH
E-C33
FOR TURNING 3/32" CHIP BREAKER TO CUT 0"-1/8" DEPTH
E-C40
FOR FACING (INTERRUPTED CUTS) 5/32" CHIP BREAKER
E-C42
FOR TURNING 5/32" CHIP BREAKER TO CUT 0"-1" DIA.
E-C41
FOR FACING TO CENTER 1/4" CHIP BREAKER
E-C44
FOR FACING 1/8" CHIP BREAKER
E-C42
FOR FACING 1/8" CHIP BREAKER
E-C45
FOR TURNING (INTERRUPTED CUTS) 5/32" CHIP BREAKER TO CUT 1/4" OR MORE
E-C46
FOR TURNING 1/8" CHIP BREAKER TO CUT 1/8"-1/4" DEPTH
FOR AMPCO #20 METAL
E-C48
FOR BORING AND FACING
E-C47
FOR TURNING

Fig. 2. Carbide-tipped tools adopted as plant standards. These twenty-nine tools can be employed for about 95 per cent of all single-point machining operations encountered in turning, boring, and facing



TOOL	ALL DIMENSIONS IN INCHES					
	A	B	C	T	W	L
G1	1/4	1/4	1	1/16	3/16	1/4
G2	5/16	5/16	1-1/4	3/32	3/16	5/16
G3	3/8	3/8	1-1/2	3/32	3/16	5/16
G5	1/2	1/2	2	1/8	5/16	7/16
G7	5/8	5/8	2-1/2	5/32	3/8	9/16
G8	3/4	3/4	3	3/16	7/16	5/8

Fig. 3. Groups of semi-standard tools designed for use on specific machines are designated by the letters G, H, P, and Q, followed by a number. This drawing, giving general dimensions of the G series, is used for reference by shop personnel

the plant. The company's experience with carbides in its own plant is thus made available to its customers.

Standardized Carbide Tools are Widely Used

A complete tool standardization program has made it possible for machine operators, after thorough on-the-job training, to requisition their own standard single-point tools for about 95 per cent of all single-point machining operations. Of the twenty-nine "plant standard" tools, most are carbide manufacturers' standards, with only grinding modifications, such as chip-breakers, needed to adapt them for use in the plant.

To facilitate the selection of correct tools by the operators, the carbide engineer has made available a series of charts (Fig. 2) that show these twenty-nine tools designed for specific routine machining purposes. Copies of these charts are placed in all machining departments, available to operators, and are also displayed over the tool-crib service window.

Adoption of this system has helped to eliminate much of the time that would otherwise be required to fabricate or procure special tools. It insures the proper tool and grade of carbide being used on each job, and simplifies the storing of tools in the tool-crib. Standardization has also accelerated the requisitioning of tools by the store-room supervisor through permitting the grouping of orders and eliminating the need of special prints, quotation requests, etc.

The planning department prepares routing sheets for each part machined. These specify the sequence of operations to be performed on the part, where each operation is to be performed, time standards, and a brief description of the operations, including specifications for any special tools required. Three separate files have been set up to catalogue and cross-index all special tools by (1) tool number; (2) function and size of tool and design details; and (3) part number, together with all other tools used for the same part. Special tools are designated by number preceded by an E.

Standard tools for routine machining, not specified on the routing sheet, are identified in the shop by a number preceded by the letters E-C. These numbers are shown on the tool chart from which the operator makes his requisition. Any stamping on a tool received from a supplier is removed before it is put into use in order to discourage partiality of the operator toward any particular make of carbide. A key number, established for plant use, is stamped on the shank of the tool to indicate the grade of carbide for identification purposes in the tool grinding room and the tool-crib.

Additional groups of standard tools made for use at specific machines are designated by the letters G, H, P, and Q, followed by a number. Tool drawings such as shown in Fig. 3, which are distributed to shop personnel for reference, carry only the necessary details. Tool grinding, store-room, and purchasing departments are provided, however, with a complete drawing, including the specifications of the carbide grade.

Centralized Grinding Assures High Tool Quality

As a part of the tool control program, all inspection, grinding, and other reconditioning of cutting tools is centralized in one department. The tool grinding room has its own supervisor, who is responsible to the plant's grinding department foreman because of the similar problems related to grinding equipment, coolants, etc. Precision grinding of tools is assured by the use of modern, well maintained grinding equipment, Fig. 4.

Tools are inspected after being returned by an operator to the tool-crib and before being put back on the shelves. If inspection shows that sharpening or other reconditioning is required, this is done and the tool is again inspected. When satisfactory, the inspector dips the tool into a molten plastic (ethyl-cellulose base), which provides a protective seal for the carbide tip and indicates that the tool has passed a rigid inspection. The inspector also helps to evaluate the condition and salvageability of damaged tools.

Only those defects that "break" across a cutting edge, showing both length and depth of crack, are considered cause for rejection of the tool. Their location and extent will determine whether the damaged part can be ground away. Any check mark across a cutting edge or any mark or crack elsewhere on the tool is ignored in the case of tools intended for plant use, since a crack seldom has any adverse effect on the tool's usability until grinding has pushed back the cutting edge to the point where the crack may affect it.

Also available for inspection of tools are templets for standard and special angles and radii, micrometers, protractors, surface-plate and dial indicators, magnifying lens, and even special gage set-ups for use with special tools incorporating compound angles or other details difficult to check with regular equipment. All tools are ground to printed specifications.

Although both high-speed steel tools (mostly multiple-point) and carbide tools are serviced in one room, grinding machines for single-point carbide tools are concentrated, so as to provide an efficient work flow from one operation to another. In this way, all single-point carbide tools can be ground by specialists, thoroughly trained in the correct handling techniques.

The introduction of centralized grinding not only contributed to an almost immediate reduction in tool breakage, but also resulted in longer tool life and lower inventories of diamond wheels and other grinding equipment, as well as eliminating all "down time" formerly caused by operators grinding their own tools. Now an additional saving is obtained by having the tool grinding room preset all carbide insert type milling cutters and similar tools. For larger machines, such as boring mills, tools are preset in the jig and fixture department.

Carbide Tool Inventories Kept to a Minimum

Inventories of carbide blanks and tools are kept to an absolute minimum. The master tool-crib (and its feeder cribs) stocks and distributes all perishable tools, as well as work-holding and

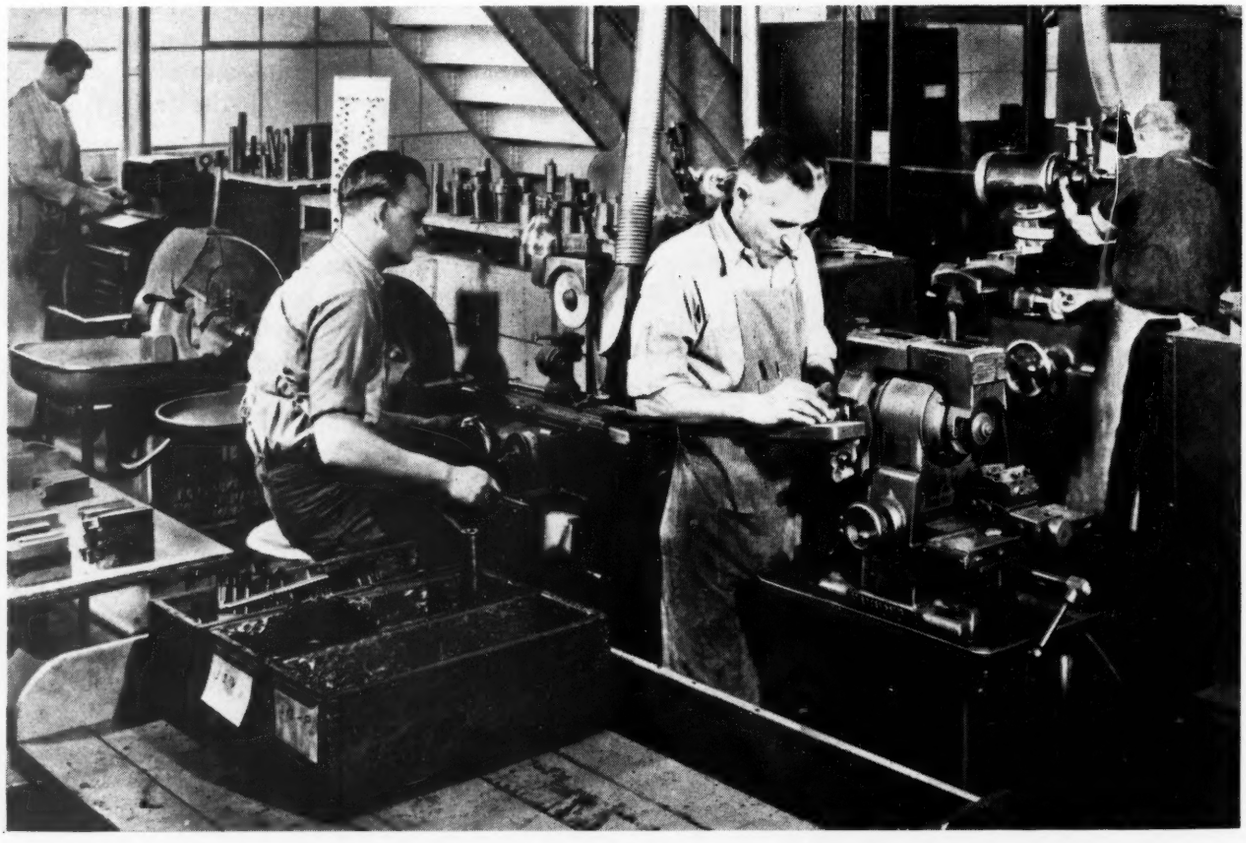


Fig. 4. Precision tool sharpening can best be performed in a clean, orderly, and well lighted area with modern, properly maintained grinding equipment and skillfully trained operators and inspectors

tool-holding devices. This crib is centrally located in relation to the main machine shop, so that operators have ready access to their tools. Standard carbide tools, stocked in quantity, are lent to operators on an exchange basis. As tools are scrapped due to wear or damage, replacements are ordered from the reserve in the stock-crib.

The stock-crib supervisor keeps a perpetual inventory control on all purchased material kept in inventory, including the reserve stock of carbide blanks and tools. As inventories are reduced to the minimum or reorder point, the supervisor draws a requisition on the purchasing department for a new supply of the particular item required. When received from a supplier, tools are added to the stock-crib inventory records. As ordered by the master tool-crib, tools are drawn from this reserve stock and sent to the tool grinding room for inspection, modification to plant standards (if required), and stamping with the plant's tool number.

Tools are "Lent" to an Operator

Each operator of a lathe, for example, starts with four standard turning and facing tools and one boring tool. These are selected to take care of most operations encountered at his particular machine. When a tool becomes dull, the operator merely takes it to the tool-crib window, seen in the heading illustration. The crib attendant examines the tool, and if it gives no evidence of abuse, he hands the operator an exact duplicate.

As mentioned previously, the tool drawn from stock has a plastic coating for protection. This coating may be broken by the operator before leaving the crib so that he can inspect the tool. If the tool has insufficient tip or insufficient overhang for the particular job on which he is working, or if it appears unsatisfactory in some other respect, the operator can reject the tool and ask for another. No paper work is involved.

The dull carbide tool is placed in a box with all others to be sent to the tool grinding room for reconditioning. Any tools rejected by machine operators are kept separated for special inspection by the supervisor of tool grinding.

All standard carbide tools are stored according to number. If an operator needs one or more tools additional to those provided at his machine, he "borrows" the tool, leaving in return a metal tag or check bearing his clock number. This is hung below the shelf from which the tool was drawn, showing which operator is "charged" with the tool. When the tool is returned, the check is given back to the operator, thereby cancelling the charge.

In the case of special tools, the operator fills out a loan order form in triplicate, with his clock number and the tool number as specified on the routing sheet. The tool-crib attendant at the service counter gives the three copies of this form to a clerk who takes from the file the proper tool charge record. The charge record shows the bin location of the tool, the number of tools in stock or in use, the name or description of the tool, and a list of any loose parts that should be issued with the tool. The clerk writes this information on the loan order, keeps two copies, and hands the third back to the crib attendant. The crib attendant takes the tool from stock and hands it, along with a copy of the loan order, to the operator.

One of the other two copies of the tool loan order is kept attached to the charge record, on which are noted the date and the department receiving the tool. The third copy is kept in a daily file as an auditing copy, to be used in the event that one of the other copies is lost. When the operator returns the tool to the crib, the return date is written in on the charge record and the two other copies of the loan orders are torn up, cancelling the charge against the operator.

The tool that has been returned to the crib is not placed immediately in stock. Each day, all returned tools are sent to the tool grinding department for inspection and any necessary reconditioning. When this is done, the tool-crib clerk enters the date and the number of the tool grinding room on the tool charge record. He can thus determine where the tool is at any time.

The tool sent to the grinding room for inspection is accompanied by a tool work order, filled out by the crib clerk. When the supervisor of tool grinding or his assistant has inspected the tool and decided what service work is necessary, the job is assigned to one of the grinder operators, whose name is written on the work order. This card is kept in an active file until the tool has again been inspected, approved, and returned to the tool-crib.

At this time, the work order is removed from the active file and placed in a file at the supervisor's desk in the grinding room. If the servicing or inspection of any particular tool is questioned, the work order will show who worked on, inspected, and approved the tool. The card is removed from the file and destroyed only when the same tool has again gone through the grinding room for reconditioning.

Broken Tools are Reported

When standard single-point tools are returned by the operator to the tool-crib, they are given a quick visual inspection by the attendant. If there

is no evidence of abuse, the man is given a duplicate tool in exchange. If the tool is damaged, the man is asked to fill out a broken tool report. This form provides spaces for checking the reason for breakage, whether due to inexperience, improper use, faulty tool, faulty machine, or accident. The broken tool report must be countersigned by the operator's foreman or supervisor before the operator can draw an exchange tool.

Ordinarily, there is no further investigation of breakage of standard tools, due to the low cost involved. However, if the reports show that any particular person is contributing to a large share of the tool breakage, this is called to the attention of the supervisor of tool grinding who looks into the matter to determine the cause.

Much the same procedure is followed in handling damaged special tools, and control is even more rigid. Damage to a special tool does not necessarily have to be discerned by the crib attendant. If the tool reaches inspection at the tool grinding room, and its abuse is first discovered at that time, the supervisor checks with the tool-crib to determine what department and individual was last charged with it. This helps the grinding room supervisor trace the source of the damage and take measures to prevent further damage.

The cost of a broken tool is not charged directly against the department responsible for it. The supervisor of tool grinding evaluates the damage and determines salvage possibilities. If the tool cannot be salvaged without loss of identity, a material requisition is made out by the supervisor of tool grinding for a replacement. When tools are ordered to replace those rejected because of normal wear, they are charged against incidental tool expenses. If ordered to replace a broken tool for which a particular department is responsible, a special account number for that department is entered on the card to show where the charge should be made.

The master tool-crib uses the material requisition to draw a tool from the reserve supply in the store-room to renew its own stock. The store-room supervisor charges the tool to his perpetual inventory, and fills in the unit cost on the materials requisition, which is sent on to the cost accounting department.

Routing Sheets Show Sequence of Operations for Each Part and Special Tool Requirements

Routing sheets, prepared by the planning department for each part to be produced, show the sequence of operations, where the operations are to be performed, and whether special tools are necessary. In the case of routine machining that can be done by standard tools, the planning department leaves the selection of tools to the operator or his supervisor. If special tools, jigs, or fixtures are required, spaces on the routing sheet are left blank for the insertion of tool numbers by the tool designing department. On re-runs of any part, the tool designing department checks specifications of special tools and indicates on a tool change record whether the prescribed tool is still satisfactory or whether another one should be used.

At present, considerable experimental work is being conducted in the field of planing, where specially fabricated tools with two circular, clamped on carbide tips are being used for roughing cuts of 5/8 inch or more through heavy scale. The results thus far, while not final or completely conclusive, have been very satisfactory and have more than paid for the efforts and costs involved.

A continual tooling improvement program is spearheaded by recommendations from shop personnel, particularly department foremen, who frequently write out a "suggestion for change" report. This is thoroughly investigated and, if found to be sound and practical, the new tooling is adopted.

* * *

National Bureau of Standards Lists New Standard Samples

More than four hundred different kinds of standard samples are available from the National Bureau of Standards, Washington, D. C. These samples comprise materials of certified composition, such as metals, ores, and ceramics; high-purity hydrocarbons; certain high-purity chemicals; paint pigments for color; oils for viscometer calibrations; melting-point standards; radioactive materials; and a number of reference standards, such as lamp opacity and reflectance standards. These standards have been established during the last forty years to meet the needs of industrial and research laboratories. They are employed for checking methods of analysis, establishing new methods effecting uniformity in testing methods, etc.

An up-to-date list designated "Standard Samples Issued or in Preparation by the National Bureau of Standards, Supplement to National Bureau of Standards Circular 398," which contains a schedule of fees, unit weights, directions for ordering, and other information on the available standards has just been published, and can be obtained free upon request from the Publications Section, National Bureau of Standards, Washington 25, D. C.

Broaching "Christmas Tree" Slots in Jet-Engine Turbine Wheels

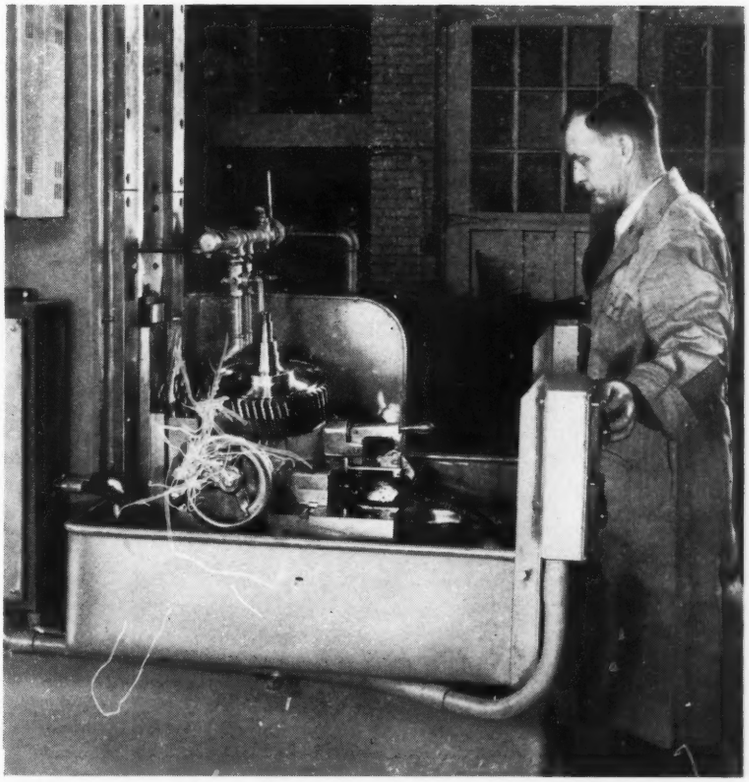


Fig. 1. Broaching machine equipped for the rough- and finish-broaching of fifty-three "Christmas Tree" slots around jet-engine turbine wheels through the use of a fixture that can be indexed laterally from the roughing to the finishing station

FIFTY-THREE "Christmas Tree" shaped slots are broached around the periphery of a turbine wheel for jet engines with the equipment shown in Fig. 1, which was made by the American Broach & Machine Co., Ann Arbor, Mich. The slots, utilized in the assembly of the turbine blades, are 1/2 inch deep, the total length of cut on each slot being 1 5/8 inches. The blank wheel is 11 3/4 inches outside diameter, and is made from wrought chromium-nickel austenitic steel designated AISI Type 316 or SAE 30316. Turbine wheels before and after broaching are shown at the left and right, respectively, in Fig. 2.

The broaching tools for this job consist of roughing and finishing insert assemblies, which are mounted side by side on a single holder. The work-fixture is held on a special receding table, and is designed to hold the work at an angle of 12 degrees relative to the broach slide. The fixture is so constructed that the operator can index the work laterally from the roughing to the finishing station without removing the work.

In an operation, the part is first secured on the manually indexed fixture; then the angular slots are rough-broached around the entire periphery of the wheel with the work located at the first station; finally, after the fixture has been traversed laterally to the second station, the slots are finish-broached. The same method can be applied for broaching slots of the dovetail and ball-root types in turbine wheels.

The machine used for this operation, illustrated in Fig. 1, is a standard 10-ton single-ram machine with a stroke of 54 inches.

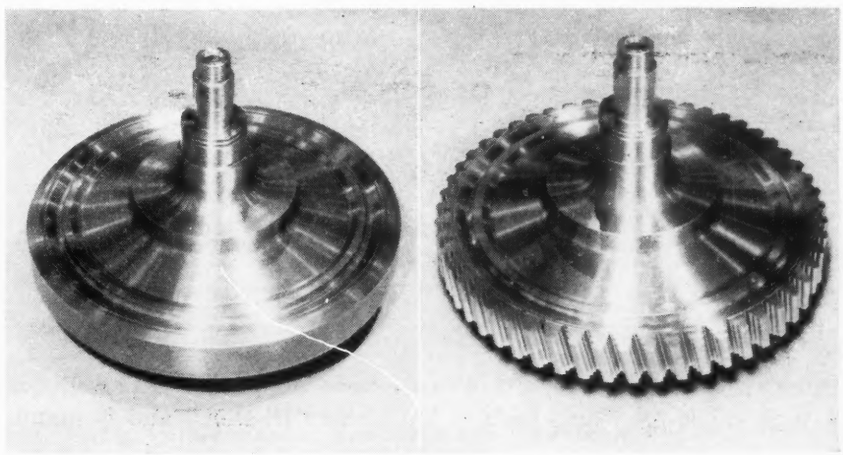
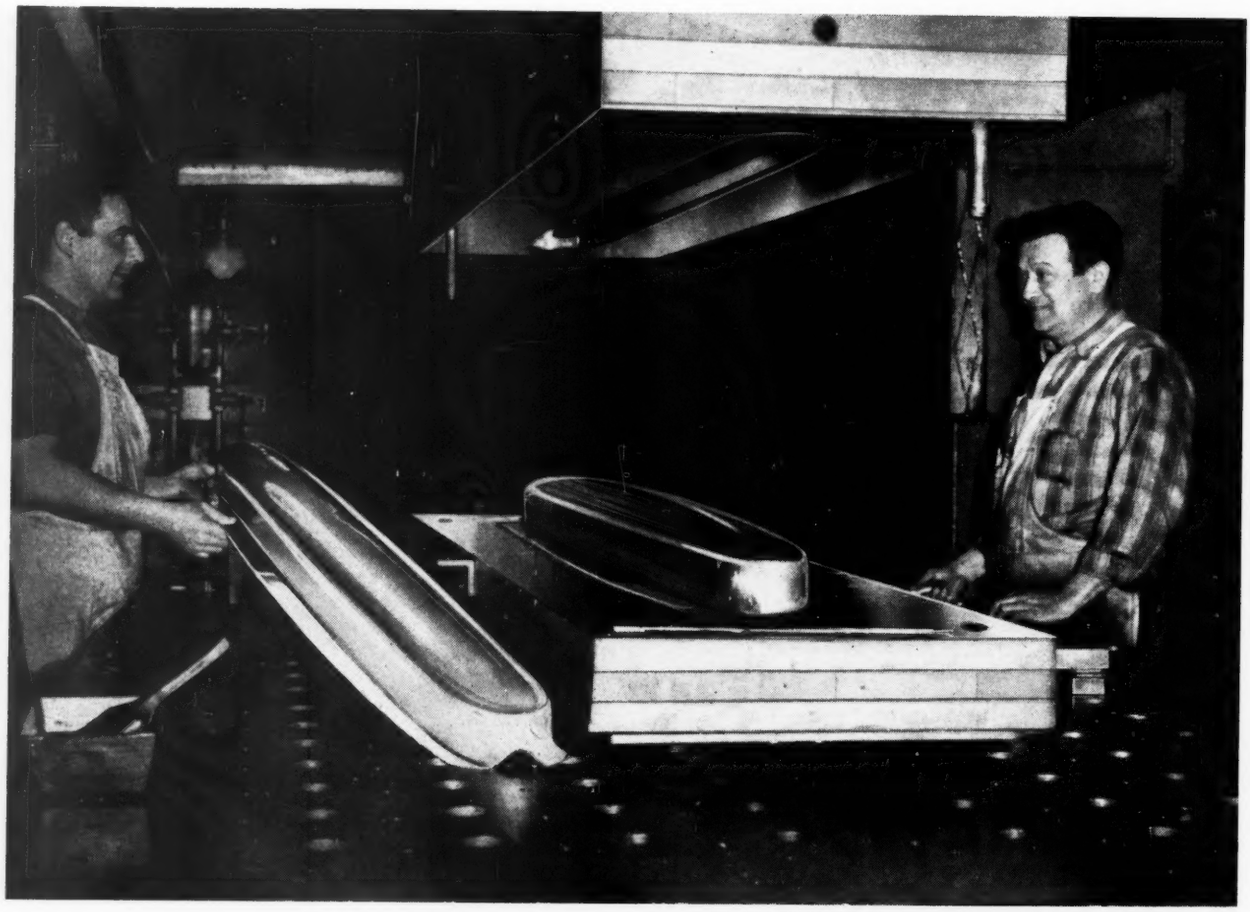


Fig. 2. (Left to right) Turbine wheels for a jet engine before and after the "Christmas Tree" slots have been broached with the equipment illustrated in Fig. 1

Densified Wood Dies Facilitate



Low-Cost, Flexible Dies Made from Densified Wood are Used by the Twin Coach Co. for Deep-Drawing and Bending of Aluminum, which Results in a More Even Distribution of Metal and Better Surface Finish

INCREASED production of improved quality products with lower tooling costs has resulted from the use of densified wood dies at the Buffalo, N. Y., Division of the Twin Coach Co. Such dies can be quickly and easily constructed or altered, and their high strength provides long life. The low coefficient of friction of the smooth dies minimizes scratching of the metal being formed, and produces an even distribution of metal in the drawn parts. A minimum production of about 200 parts is generally required to warrant the use of densified wood tooling.

Miscellaneous aluminum-alloy parts drawn in densified wood dies are shown in Fig. 1. The utility box seen at the upper right is drawn to a depth of 6 inches from 0.064 inch thick 3S aluminum alloy. The box measures 14 inches long by 24 inches wide. In general, the depth of draw can be increased as much as 50 per cent by substituting densified wood for steel dies.

A typical densified wood drawing die employed to form aircraft fairing from 0.051 inch thick 14S-O aluminum alloy is seen in Fig. 2. The part *A* is drawn 5 inches wide by 13 inches long, to a depth of 2 1/2 inches. Densified wood is used only for the wearing surfaces *B* of the punch *C* and die *D*. The densified wood is backed up by birch, Masonite, or plywood layers *E*, and the surfaces of the punch and die that grip the blank during forming are made from sheet steel, as indicated at *F*.

Densified wood or "compreg" employed for such tools is known as "Hi-Den," and is manu-

Forming of Aluminum

By JAMES MILLIKEN
Tool Superintendent
Buffalo Division, Twin Coach Co.

factured by the Parkwood Corporation, Wakefield, Mass. It is made from selected layers of birchwood that are impregnated with Bakelite phenolic resin and compressed to approximately 50 per cent of their original thickness. The composite material is cured by subjecting it to high pressures and elevated temperatures. This treatment transforms the wood into a tough, hard water-resistant material having high dimensional stability. Cross ply construction is employed to provide uniform strength characteristics in all directions.

Physical properties of this grade of Hi-Den are: Specific gravity, 1.30; tensile strength, 15,000 pounds per square inch; modulus of rupture, 20,000 pounds per square inch; Izod impact, 3 foot-pounds per inch of notch.

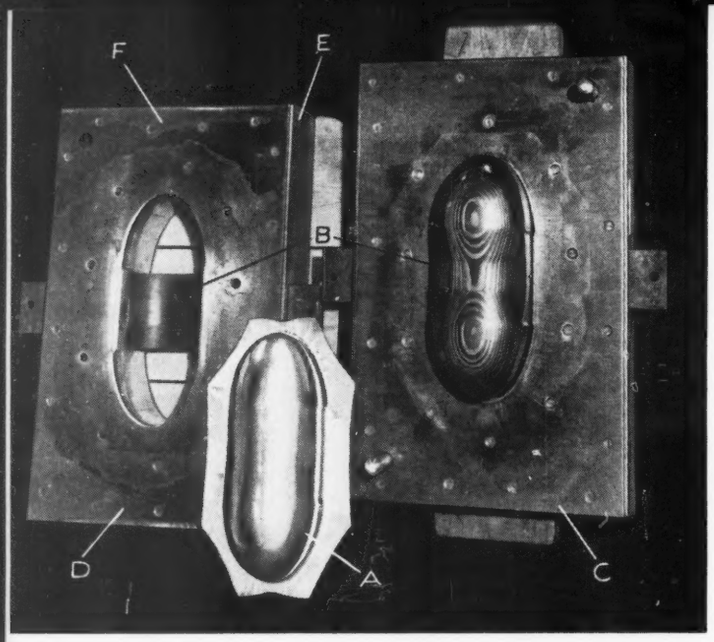
The material is purchased in flat sheets, 30 inches wide by 48 inches long and from 0.110 inch to 2 inches thick. Conventional wood-working equipment can be employed to machine the material to the desired shape. Wood-working planers or jointers, however, should not be used on this material, as it will cause breakage of the blades.

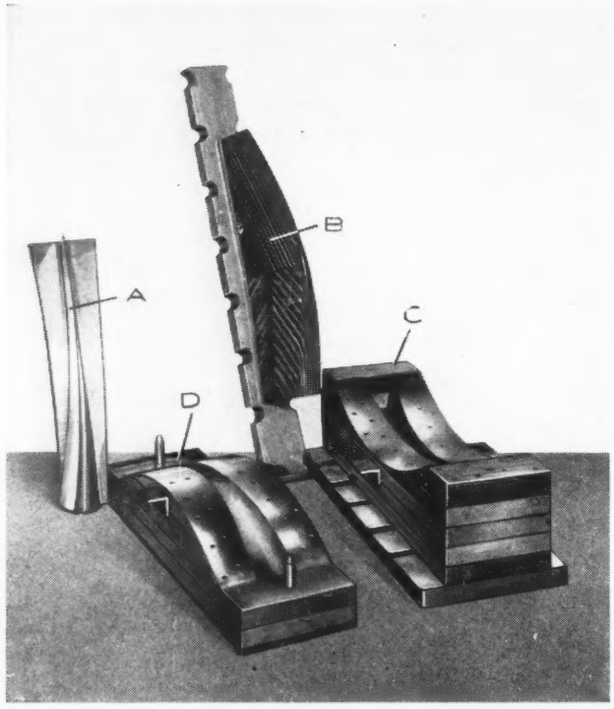
A good surface finish is obtained in holes or on threads with carbon steel drills or taps. A fly cutter, mounted in the spindle of a drill press, can be used to counterbore densified wood. Hand scraping tools, buffing wheels, or sanding machines produce good surface finish. A tolerance of $\pm$ 0.005 inch is generally specified on such dies.

An aircraft-wing aileron tip *A*, Fig. 3, is drawn to a depth of 2 3/4 inches from 0.025 inch thick 24S-O aluminum alloy by means of densified wood punch *B*. The part is approximately 30 inches long, and is drawn to a sharp edge along its trailing surface. Steel-faced wood die *C* and pressure pad *D* are employed for this deep-drawing operation, which is performed on a 500-ton hydraulic press made by the Hydraulic Press Mfg. Co. The upper half of the punch, as shown, consists of one piece of densified wood that extends downward through the center of the lower half. The heavier section required in the lower half of the punch is of built-up construction, a piece of densified wood being screwed to each side of the upper half extension.

A particularly difficult deep-drawing operation that has been performed on a mass production basis in a "compreg" die with excellent results is seen in the heading illustration. The part is 8 inches wide by 84 inches long, and is drawn to a depth of 5 inches from 0.051 inch thick 61S-O aluminum alloy. A Clearing 750-ton hydraulic press is used for the operation. More than 5000 parts have been produced at the rate of fifty per hour without requiring die maintenance or replacement.

Fig. 1. Miscellaneous parts drawn from various gages and alloys of aluminum in densified wood dies





The punch is built up of layers of densified wood to a thickness of 3 inches, and is backed by strips of birchwood. Steel sheets are provided on the ends of the punch to facilitate slipping the drawn part from the punch. A lubricant is employed for this operation, but the oil has no effect on the life of the densified wood.

Excellent metal flow is obtained between the smooth densified wood surfaces, providing a very good surface finish on the drawn parts. Sharp corners can be produced with a minimum of tearing. There is a smooth sliding action, without slippage, between the gripping surfaces of the punch and die, so that very little thinning out of the metal takes place. No gripping bead is required, as is common practice in conventional deep-drawing dies.

"Compreg" dies can be easily adapted to suit changes in the design of a product by building them up or machining them as required. If necessary, patches can be inserted in the densified wood to change the contour of a part. This method, however, is only practical for large dies, since patches in smaller dies will mark the part. When thicknesses greater than 2 inches are required, sheets can be joined by spreading Penacolite glue on them and clamping under a pressure of about 50 pounds per square inch. After seven hours of drying, the material can be machined. "Compreg" sheets can be joined more economically and effectively with machine screws or studs if the design will permit such construction. Densified wood can also be bonded to metal by using a metal bonding cement and a phenolic adhesive.

Tooling costs have been substantially reduced at the Twin Coach plant by the use of "compreg." It has been estimated that the actual cost of a densified wood die, including raw material and

Fig. 2. (Top) Densified wood is employed for the wearing surfaces (B) of this punch and die. Part (A) is drawn to a depth of 2 1/2 inches

Fig. 3. (Center) Aircraft-wing aileron tip (A) is drawn to a depth of 2 3/4 inches and a sharp trailing edge by means of densified wood punch (B)

Fig. 4. (Bottom) Long-wearing, chip-resistant strips of densified wood are used for the bottom edges of wood form blocks used in routing and shaping

fabrication costs, is approximately one-third that of a comparable Kirksite or steel die. Maintenance costs are also lower, and less scrap is produced. Limited figures are available on the life of "compreg" dies, since none have worn out yet, but indications are that they will last about ten times as long as a Masonite die. The lightness of "compreg" dies (which weigh approximately one-fourth as much as steel dies) reduces fatigue of the operator and facilitates changing dies.

Densified wood has been successfully applied to tools other than drawing dies, punches, and pressure pads. Included in such applications are form blocks for stretch-forming aluminum, spinning chucks, bending brake dies, tube bending blocks, inspection fixtures, and drilling, sawing, and spot-welding jigs.

An unusual application is shown in Fig. 4, where densified wood is used on the bottom edges of a shaper form block. The part to be trimmed is held in the wood form block, located on the table of a Whitney shaper. The block is fed toward the cutter until the "compreg" guide strips contact the roll directly below the cutter. Then the block is fed past the cutter, keeping the strips in contact with the roll to trim the part to the desired shape. "Compreg" strips, 1/2 inch thick by 2 inches wide, are machined to the desired contour for this application.

Similar guides are employed for router blocks, since the chips will not become embedded in the "compreg," and a life of about ten times that of steel wear strips is obtained.

Form blocks for tube bending machines, Fig. 5, have been made from densified wood with very good results. A 63S-O aluminum-alloy extrusion, 1/8 inch thick and 98 inches long, is shown being bent on a Parker tube bending machine. The extrusion is bent through an angle of 90 degrees to a radius of 4 1/2 inches. Smooth surfaces are produced on the part, with no wrinkling or buckling.

Copper tubing, 1 1/4 inches in diameter, with a wall thickness of 0.049 inch, is bent through an angle of 90 degrees to a radius of 3 3/4 inches with the "compreg" form block seen at the left.

The densified wood dies seen mounted on a Cincinnati press brake in Fig. 6 are used to form aircraft wing-section stringers from flat sheets of 0.051 inch thick 14S-O aluminum alloy.

* * *

Temperatures as high as 4000 to 4500 degrees F.—almost twice that required to melt iron—are produced at times in the cylinders of automobile engines.

Fig. 5. Smooth surfaces and a minimum of wrinkling are obtained in bending tubes and extruded shapes with densified wood form blocks

Fig 6. Stringers for aircraft-wing sections are formed from flat sheets of aluminum alloy with "compreg" dies on a press brake

Engineering News

World's Largest Traction Dynamometer Used to Test Army Tanks

The world's largest traction dynamometer is now being used at the Aberdeen Proving Ground in Maryland, to test the U. S. Army's largest tanks and other military motor vehicles. This dynamometer is a 60-ton, 1000-H.P., electrically driven, sixteen - wheel combination truck and dynamometer. It is about 50 feet long, 11 feet wide, and 12 feet high. The combination unit operates as a self-propelled truck, as a dynamometer or electrical power-absorption vehicle, and as a prime mover or electric towing tractor.

This tractor dynamometer is equipped with nineteen electric generators and with instruments that record draw-bar pull, acceleration, road speed, track speed, engine speed, and fuel flow of tested vehicles, whether wheeled or tracked and regardless of size. It is capable of providing a continuous draw-bar pull of 60,000 pounds at speeds of 2 to 45 miles an hour. Instrumentation is centralized at a control desk and panel, operated by four men, in the 9-foot square, air-tight, blower - pressurized, spring-mounted truck cab. The instrument readings are recorded by still and motion picture cameras.

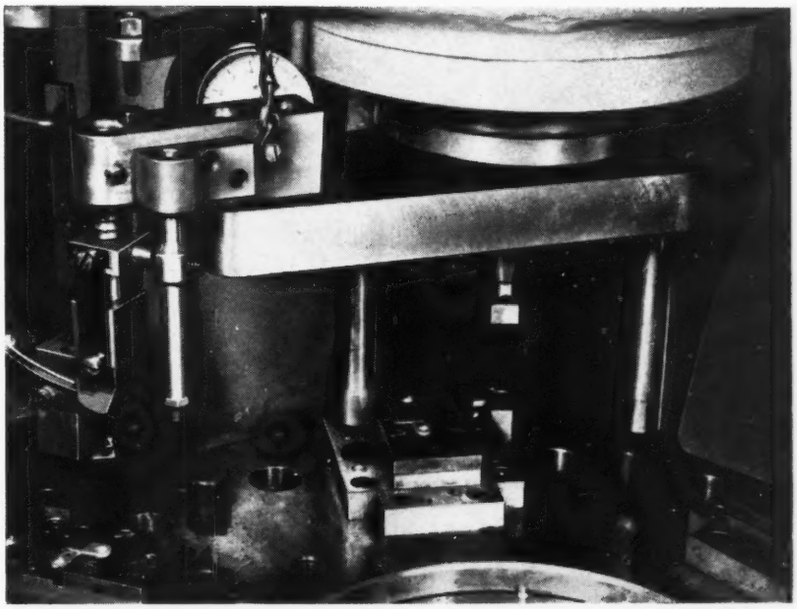
Rapid Selector Machine Stores Vast Amounts of Information

An "electronic brain" machine known as the "Rapid Selector" has been developed jointly by the U. S. Department of Commerce and the U. S. Department of Agriculture. This machine stores vast amounts of scientific information, automatically pores over it, selects what is sought by the operator, and then hands him copies of what he wants. To do this, the "Rapid Selector" makes use of 35-millimeter motion picture films, on each reel of which can be stored the contents of almost 500,000 conventional library cards.

When the information is microfilmed, a predetermined code pattern, consisting of black and white squares, is simultaneously printed on the film, indicating the subject to which the information relates. The selector, which can potentially be coded for ten million different subjects, scans the patterns of light and dark accompanying each film frame, looking for a particular pattern to match the master key inserted in the machine. When the two coincide, a flashlamp is fired, photographing the frame passing through the scanning area at that instant and resulting in a copy of the item of information desired.

A unique method of examining metal structure to determine quality and to aid in the development of improved materials has been devised by the Ford Motor Co. It utilizes ionized atoms, and is called "cathodic vacuum etching." The illustration shows a metal sample being tested in the applied physics research department of the company. The metal is placed in a partial vacuum containing argon, a rare gas. A charge of 12,000 volts of electricity is sent into the vacuum. This creates argon ions which bombard the surface of the metal, knocking off minute particles and bringing out the true microstructure of the metal with greater detail and clarity

Automatic Riveting Boosts Production of Small Parts



HIGH-VOLUME production of electric ranges, refrigerators, and other household appliances requires the processing of hundreds of thousands of small precision parts, such as tiny electrical contacts. To reach an efficient output on such parts, Hotpoint, Inc., Chicago, Ill., devised means for automatically riveting silver contacts to spring steel and bronze arms. For this purpose, special dial fixtures and ram tools were designed for use with a standard oil-hydraulic Multipress and indexing table, Fig. 1, made by the Denison Engineering Co., Columbus, Ohio. With this automatic hydraulic equipment, more than 900 contacts can be produced per hour.

While the operation itself is relatively simple, highly accurate control of the ram pressure is of prime importance. The number of silver contacts to be riveted to each contact arm determines the number of hoppers required to feed the rivets. Two hoppers, made by the Detroit Power Screwdriver Co., Detroit, Mich., are employed in the set-up shown.

Automatic indexing of the table, coupled with the automatic hopper feeds, reduces the loading time considerably. The operator is only required to load the contact arms into fixtures at the stations seen at the front of the indexing table and to keep ample supplies of the component parts on hand. It is possible for unskilled operators to produce high quality work.

The loaded fixtures automatically index in a clockwise direction beneath the hopper feeds, seen at the left rear. Every downward stroke of the press ram opens the feeding jaws on each hopper slide, permitting the contacts to drop into the desired position on the arms. The fixtures are then moved automatically to the pressing station, Fig. 2, for the riveting operation. Finally, the completed contact arm is indexed to the ejection station seen at the far right, where a blast of air from a valve actuated by the press ram blows the finished piece through a chute into a tote pan.

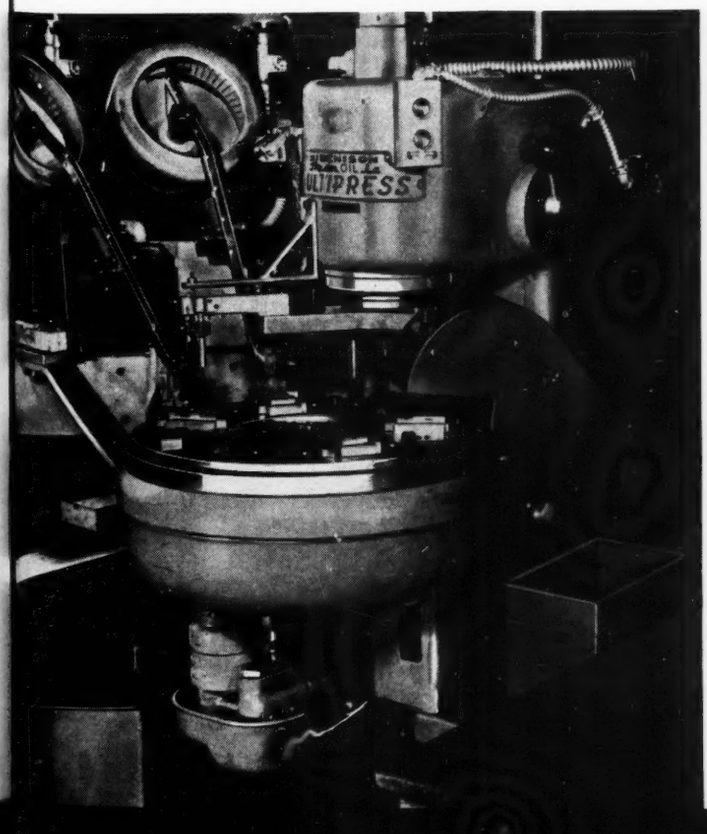
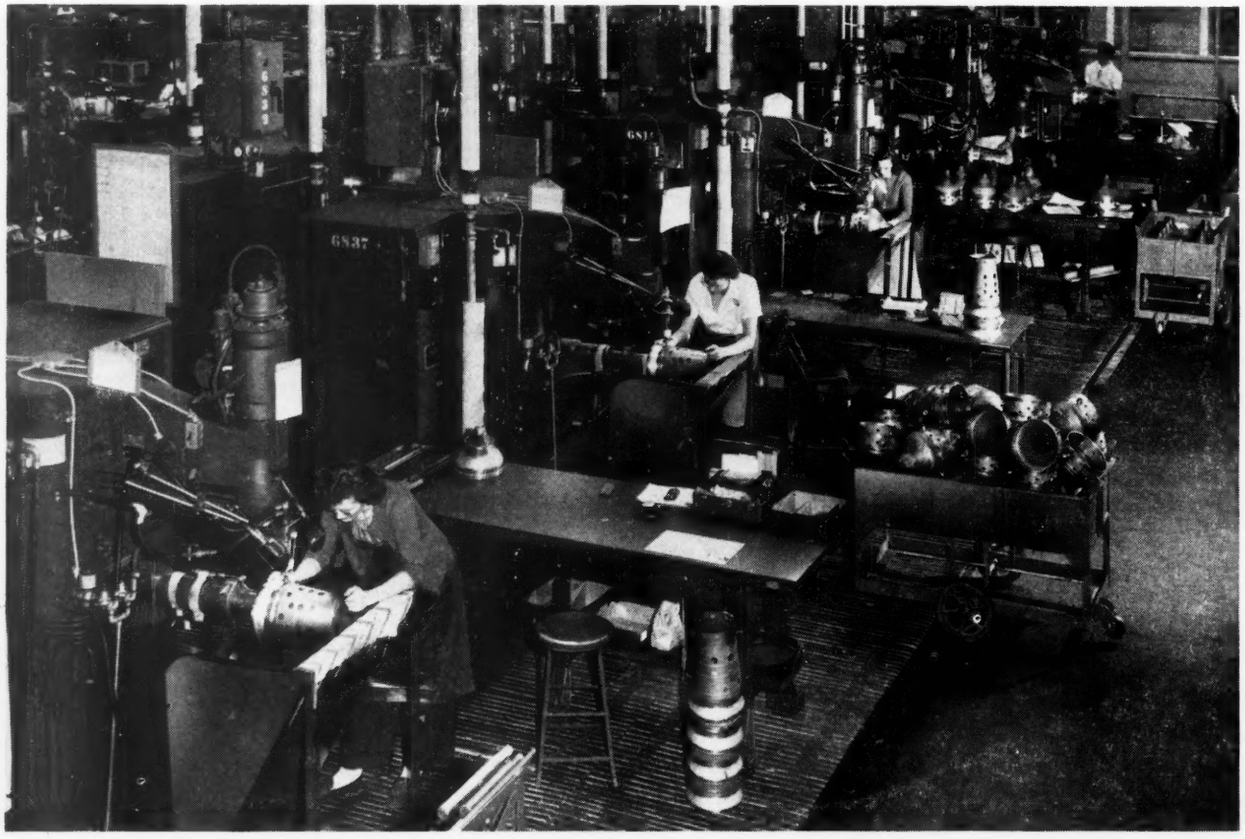


Fig. 1. (Left) Electrical contacts are automatically riveted at the rate of over 900 per hour on a press equipped with hopper feeds and indexing table

Fig. 2. (Above) Close-up view of the riveting station of the set-up shown in Fig. 1. Completed contact arms are blown up the chute seen at the far right

Welding Sheet-Metal Components



Rigid Quality Control and Precision Welding Methods Employed in Joining Sheet-Metal Components of the "Turbo-Wasp" Engine — Second of Two Articles

IN the July number of MACHINERY, pages 152 to 159, some of the precision manufacturing operations performed on sheet-metal components of the "Turbo-Wasp" jet airplane engine were described. The present article describes the welding of such sheet-metal parts and the methods employed to insure the high degree of accuracy required in work of this kind at the Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford, Conn. The flame tube, or combustion-chamber liner, the outer casing, or burner shell, the exhaust duct, and the exhaust-unit inner cone are representative of the many sheet-metal assemblies that require precision welding techniques for maximum resistance to the great stresses encountered in service.

Stamped, rolled, and deep-drawn components of these assemblies are made up mainly of such high-strength, corrosion-resistant metals as 18-8 stainless steel, and a heat-resistant chromium-nickel-iron alloy of austenitic grain structure known as Nimonic 75. Because the characteristics of the work before welding are important to the quality of welded joints, precise control is maintained over the size, thickness, and contours of mating parts. Moreover, great care is taken to insure good surface finishes, cleanliness, and satisfactory grain structure of these metals.

Although fusion welding is used to some extent, resistance welding is the principal means of joining sheet-metal assemblies in this plant. A welding operation on a typical sheet-metal assembly is shown in Fig. 1. Here a 50-KVA portable welder is being employed to tack-weld together the front and rear sections of a burner shell. Before the final welding, all assemblies of this type are tack-welded after being accurately positioned in fixtures such as the one illustrated.

These two sections of the burner shell are precisely clamped in position over a central locator

# of Turbo-Jet Engines

By GEORGE H. DeGROAT

in the fixture, which also has radial, three-point contact locators outside the work, so that eccentricity between the two members is held to a minimum. This is essential in order to maintain a uniform flow of air between the burner shell and the flame tube in operation.

Prior to the tack-welding operation, a flange, machined from a low-carbon steel casting, was spot-welded to the front section of the assembly and then brazed to provide an air seal at the joint. Next, a ring was seam-welded to the rear section, after which the assembled sections were put in the fixture for tack-welding.

Following the tack-welding, the joint is seam-welded and a face machined on the front flange for locating the assembly in the fixture shown in Fig. 3. Here two bosses are clamped in position for the tack-welding operation illustrated in Fig. 2. The bosses, which are used for mounting interconnector tubes between adjacent combustion chambers, are held in the correct radial position within ± 0.003 inch, and in the required axial position within ± 0.005 inch.

At the same time that these bosses are joined to the assembly, an igniter boss is welded to those burner shells that are to occupy the third and eighth positions in the nine radially positioned combustion chambers. Two igniters are used in this engine, and the other burners are fired through the interconnector tubes.

Following the welding operations, the burner shell flange is faced and turned and the ring bored, faced, and turned as illustrated in Fig. 4. Holes are drilled in the flange, using the set-up shown in Fig. 5, and the entire assembly is then subjected to a pressure test consisting of 125 pounds of hydrostatic pressure and 50 pounds of air pressure.

Final operations on the assembled burner shell include chromium-plating the ring at the rear section to a thickness of 0.002 to 0.003 inch to prevent galling during expansion and contraction in service. The entire inside and outside is sand-blasted and then metal-sprayed, using pure aluminum wire, to a thickness of 0.004 to 0.006 inch to increase corrosion resistance (Fig. 6).

Fig. 1. A locating fixture holds two parts of combustion-chamber outer casing, or burner shell, for tack-welding

Fig. 2. Tack-welding interconnector bosses to burner shells, using a fixture to insure accurate location of welds

Fig. 3. Interconnector bosses are positioned in a locating fixture previous to tack-welding to a burner shell

All welded joints are controlled by assembly prints which specify the type, location, and strength of welds, as well as by welding quality standards which cover each particular assembly. Operation sheets provide definite instructions on machine settings for electrode pressure, current, and time, as well as the relationship of assembled parts in fixtures and the actual welding. These standards include photographs at 20 magnifications of macrosections of representative welds, showing acceptable, marginal, and rejectable joints for comparison purposes.

A laboratory is used to control the quality of all weldments by thoroughly testing sample welds before and after production runs. Test joints are made by welding together two or more pieces prior to beginning the production welding. These test pieces, which are made from centers and trimmings, are subjected to macro-examination and destructive testing. Stock thicknesses of these pieces are held to within 5 per cent of the thickness of the actual parts, and in this way, metal of the same analysis, shape, and size is available for the accurate testing of joint efficiencies.

The test joints are made in accordance with welding specifications for the assemblies, and are submitted to the laboratory for approval. Weld numbers are assigned to the test joints, and corresponding numbers are placed on the joints of the actual assemblies when they are welded. After production welding, another test joint is made and submitted to the laboratory for approval, after which all test pieces of a particular

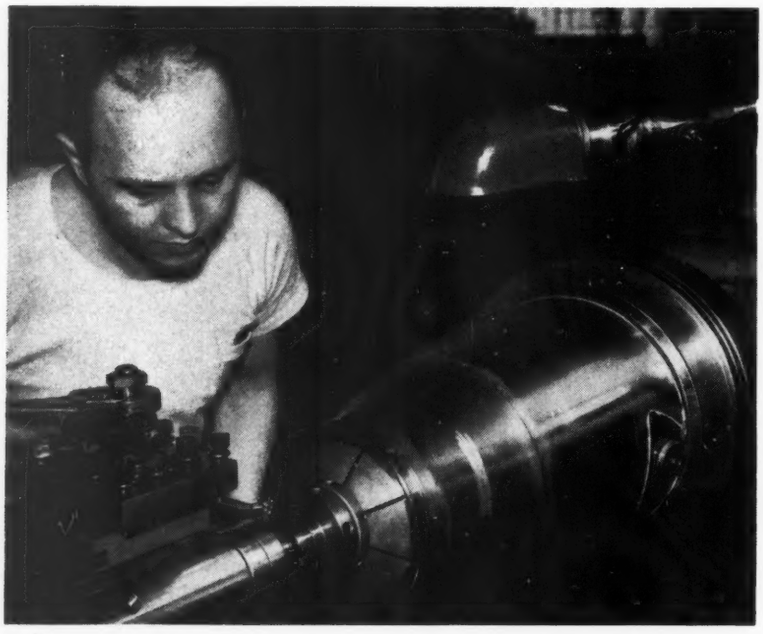


Fig. 4. Machining operations after welding burner shell components together include boring, turning, and facing a ring at the rear section

production run are filed according to the assigned weld number to provide a record of the quality of the weldments on the assemblies.

Often after minor changes have been made during a production run, intermediate tests are carried out to insure that the quality of the weldments has not been affected. Such changes may consist of electrode alignment adjustments, change of operators, etc. Welds on these assemblies are further examined radiographically by means of a 220,000-volt X-ray machine in the laboratory.

The resistance welding equipment used for this work (see heading illustration) includes standard spot- and seam-welders of the press type with throat capacities ranging from 24 to 36 inches. All the machines have electronic controls for synchronous timing of heat and pressure, and electrical capacities range from 50 to 250 KVA.

The welding of heat-resistant materials requires relatively high pressures, compared to heat. Electrode pressures are generally 18,000 pounds per square inch for the resistance welding of low-carbon steel, and about 30,000 pounds per square inch for heat-resistant alloys.

Relatively small-diameter electrodes are used to obtain the small amount of overlap at the welded joint that is desirable for service under high-velocity air flow. As a result, electrode life is greatly reduced. This factor considerably narrows the range over which successful welding can be done, thereby adding to the need for rigid quality control.

In many assemblies, the quality of a weldment is greatly improved by the use of electrode guide fixtures, which insure that the weld will be in the proper position relative to elements of the assembly.

A typical electrode guiding fixture may be seen in Fig. 8, where the stitch-welding of a bar sleeve to an exhaust duct is illustrated. After tack-welding the bar sleeves to the duct in the fixture illustrated in Fig. 7, the round plastic electrode guiding fixture is placed over each bar sleeve. Graduations on the fixture, which is free to rotate, are aligned with a mark on the duct, and the electrode, guided through a close fitting hole in the fixture, evenly spaces the stitch welds as the fixture is indexed. Incidentally, a flat on the bar sleeve necessitates the use of a second electrode guiding hole located closer to the body of the bar sleeve.

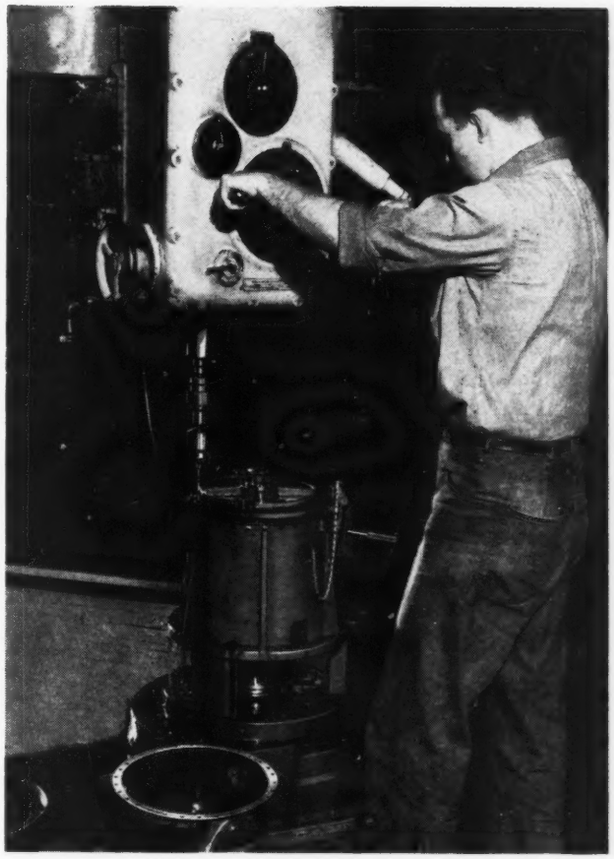


Fig. 5. Drill jig used in a radial drilling machine to locate holes accurately in the welded flange of a burner shell

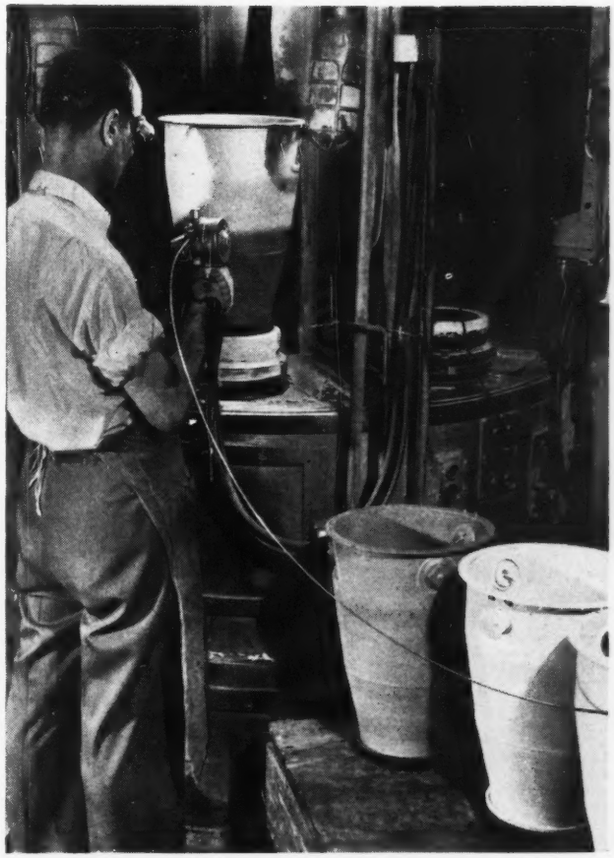


Fig. 6. To improve the corrosion resistance of burner shells, they are sand-blasted and metal-sprayed, using pure aluminum wire, to a thickness of 0.004 to 0.006 inch

Fig. 7. Bar sleeves are accurately located for tack-welding to the exhaust duct before final welding by the use of the special fixture shown

Fig. 8. An electrode guiding fixture is utilized to evenly space the overlapping spot-welds in stitch-welding bar sleeves to the exhaust duct

Fig. 9. Plastic fixture with electrode guiding elements that insures uniformity in spot-welding the exhaust-unit fairing components

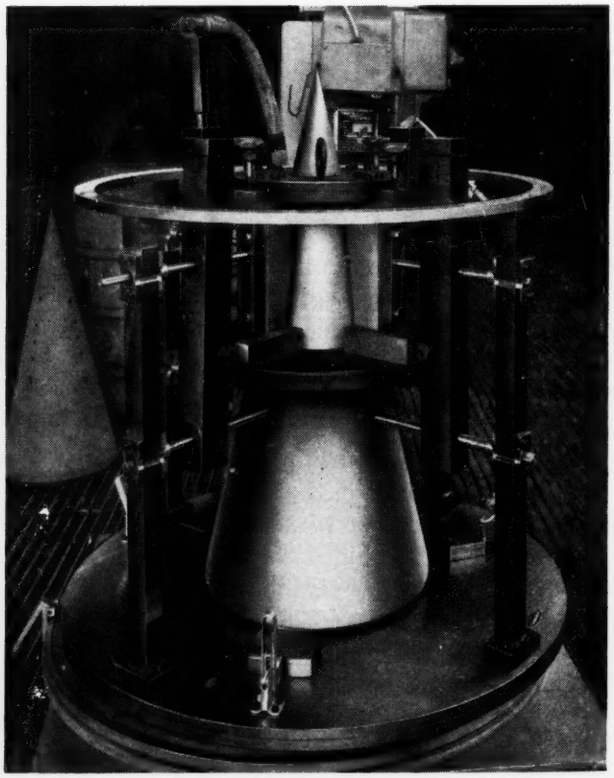


Fig. 10. A typical welding fixture that is used for locating the sleeves on the outer duct of the exhaust unit prior to tack-welding

A plastic fixture having electrode guiding elements is illustrated in Fig. 9, where the spot-welding of the exhaust-unit fairing components may be seen. The fairing consists of four spacers or ribs, made of 18-8 stainless steel, and a Nimonic skin, welded together to form an airfoil. The fixture is slotted to guide the electrode along the airfoil contour where the rib flanges are located. This fixture accurately holds the skin piece and two long spacers during the first operation, while the welds are being made along the flanges on the spacers from the outside of the skin. A removable electrode, inserted between the flanges of the spacers, carries the current from the outside spot at the skin through the uppermost flange to the lower flange. Spot-welds are precisely spaced by means of a spring-loaded pin on the carriage and spacer holes in the base of the fixture.

After spot-welding the two spacers to the skin, one long rib and a short rib are assembled in the fairing and the procedure repeated. The second operation is followed by clamping and stitch-welding the trailing edges of the airfoil, after which the seal plates are tack- and stitch-welded to the assembly.

The fixture illustrated in Fig. 10 is used to locate the sleeves on the outer duct of the exhaust unit relative to those on the inner cone previous to tack-welding. Several other fixtures are employed to insure the high quality of the engine components, including straightening and accuracy checking fixtures.

The results of the precision methods employed to fabricate these sheet-metal components of the JT-6 "Turbo-Wasp" are evident in several ways. For example, the fairings and the inner cone and outer duct of the exhaust unit are interchangeable without machining the tie-rod supports after assembly. The liner support bosses on the burner shell are held within plus or minus 0.003 inch of their true radial position—from tack-welding through final welding and silver brazing —without requiring machining. Moreover, in tests, flame tubes subjected to elevated combustion temperatures and high-velocity air flow operate for 150 hours without deterioration of the welded joints.

Main floor of the machine shop in the research laboratories of the Gulf Oil Corporation. This shop supplies all the metal-working requirements of the laboratories and also produces most of the parts assembled into geophysical prospecting equipment which is used in Gulf exploration activities throughout the world

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Silicone Rubber Bonded to Fiberglas, Asbestos, Wool, or Cotton

The availability of silicone rubber bonded to Fiberglas, asbestos, wool, or cotton has recently been announced by the Stalwart Rubber Co., 157 Northfield Road, Bedford, Ohio. Bonding of this synthetic rubber to these materials gives greatly increased strength and adapts them for high-pressure gasket and diaphragm applications.

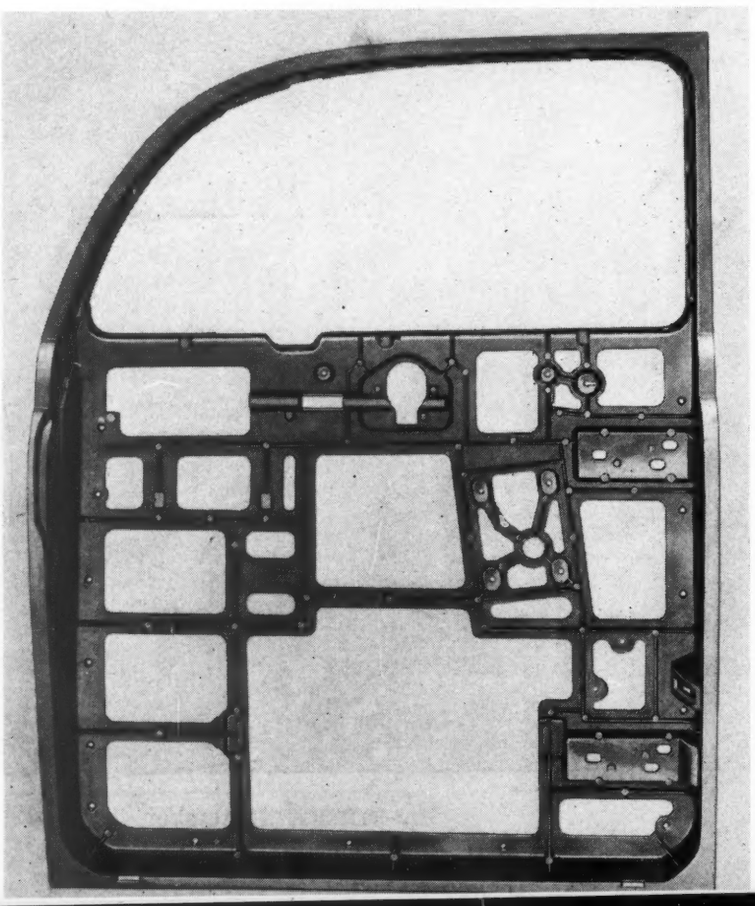
Both molded and die-cut parts have been fabricated from the new bonded materials. When silicone rubber is bonded to either Fiberglas or asbestos, the parts will remain unaffected at temperatures ranging from minus 160 to more than 400 degrees F. When bonded to wool, the fabricated parts are suitable for applications involving constant temperatures up to 300 degrees F. and intermittent temperatures up to 400 degrees F. Bonds of silicone rubber and cotton will withstand temperatures up to 250 degrees F.

Parts fabricated from the new bonded materials will not become carbonized at maximum heats, and will withstand permanent compression, prolonged weathering, and hot lubricating oils. 201

Corrosion- and Fatigue-Resistant Alloy Used in Springs

A corrosion- and fatigue-resistant spring alloy known as "Elgiloy" is a recent product of the Industrial Products Division of the Elgin National Watch Co., Aurora, Ill. This alloy is being used in the manufacture of springs of many types. Further applications are corrosion-resistant valves, stainless cutlery, scales, razor blades, cameras, surgical and dental equipment, chemical processing equipment, and electronic parts. It is also proving useful in applications requiring a completely non-magnetic material.

Most outstanding of the properties of the new alloy are its extreme resistance to corrosion, set, and fatigue. Five hundred hours of exposure to



Aluminum die-cast automobile door frame, said to be the largest die-casting in area ever made, which is now in production by the Doehler-Jarvis Corporation. The die-casting covers an area of approximately 1200 square inches and weighs slightly more than 12 pounds when trimmed. Use of this door frame saves about 35 pounds in weight of a four-door car

salt spray produced no evidence of rust, and corrosion hazards such as high humidity and fingerprints have no harmful effect. 202

Synthetic Cleaner Prepares Metal for Surface Processing

A synthetic cleaner, known as "Quaker Formula 100," has been developed by Quaker Chemical Products Corporation, Conshohocken, Pa., for the removal of mineral-oil type soils. This product, which is in the form of a powder, is used with water as a tank type cleaner, and will prepare metal surfaces for bonderizing, electroplating, painting, and other critical operations with an immersion time of less than two minutes in the cleaning cycle. It can be applied to the cleaning of steel, brass, die-castings, and aluminum. With the latter material, the extremely fine-grained but superficial etch produced yields unusually good paint adhesion. 203

Strippable Coating for Spray Booths and Product Protection

Chemclean Products Corporation, 64 Sixth Ave., New York 13, N. Y., has developed a strippable protective coating which has a variety of useful applications in metal products manufacturing plants. This material, called "Chem-Peel," is a plastic emulsion that can be applied either by spraying or dipping and imparts to the surfaces treated a film of plastic which can easily be removed by peeling.

When applied to the surfaces of dry spray booths, it acts as a barrier coating between the booth walls and the accumulated overspray, which can easily be removed by simply pulling off the coating in one continuous sheet. Many objects that are plated or finished with an organic coating can be protected against corrosion, scratches, finger marks, dirt, etc., by applying Chem-Peel, which can easily be removed later by peeling. It is also useful in protecting articles with a high finish from the scratches which normally occur during stamping or forming....204

High-Strength Industrial Ceramics for Mechanical Uses

Several high-strength, industrial ceramics have recently been introduced by the Coors Porcelain Co., Golden, Col., which should find application in the manufacture of mechanical parts. The high resistance to heat of these ceramics adapts them for applications where metals have not been entirely satisfactory. Resistance to corrosion and low coefficient of friction make them valuable for high-pressure use in valve parts and bearings. Resistance to abrasion and high compression strength make them suitable for grinding balls, nozzles, extrusion dies, surface plates, plug and ring gages, pump parts, valve parts, and bearings.

The ceramic parts are made with close tolerances and fine finishes in various types for specific services. Physical properties vary according to the type. AI-200 Alumina, for example, has a tensile strength of 25,000 pounds per square inch, a compression strength of 290,000 pounds per square inch, a coefficient of expansion about one-half that of steel, a specific gravity of 3.63, and a hardness comparable to natural sapphire. 205

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in September, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

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Cincinnati Bickford Celebrates Diamond Anniversary

SEVENTY-FIVE years ago, Henry Bickford went to Cincinnati, Ohio, from New Hampshire and started to build upright drilling machines in a small shop at Front and Pike Sts. In 1887, the business he had originated was taken over by what was then known as the Bickford Drill Co., who continued to manufacture these machines. Several years later, the company expanded into the radial drill field and erected a larger building on the same site. At this time the name of the company was changed to the Bickford Drill & Tool Co.

In 1894, August H. Tuechter, who had been connected with both the Bickford Drill Co. and the Bickford Drill & Tool Co., and Sherman C. Schauer, who had been associated with the Hamilton Machine Tool Co., formed the Cincinnati Machine Tool Co. Fifteen years later, the Cincinnati Machine Tool Co. and the Bickford Drill & Tool Co. were merged, adopting the present name, the Cincinnati Bickford Tool Co. A new building was erected at Oakley, at that time a distant suburb of Cincinnati, and the manufacture of both upright and radial drilling machines was continued, with Mr. Tuechter as president and Mr. Schauer as vice-president and general manager, the position the latter held until his death in 1918. In 1925, the trademark name of "Super Service" was introduced to cover the company's all-geared, completely anti-friction bearing machines.

During 1941 and 1942, a major expansion and construction program was undertaken, which practically doubled the facilities of the factory, and a new office and engineering building was added.

The death of Mr. Tuechter in 1947 necessitated a reorganization of the directorship of the company, and in March, 1948, the following officers were selected: George P. Gradolf, chairman of the board and treasurer; Ozni E. Schauer, president and general manager; Neil C. Schauer, vice-president and sales manager; L. Lee Schauer, vice-president and chief engineer; Paul E. Heckel, secretary; C. Charlton Slete, assistant treasurer.

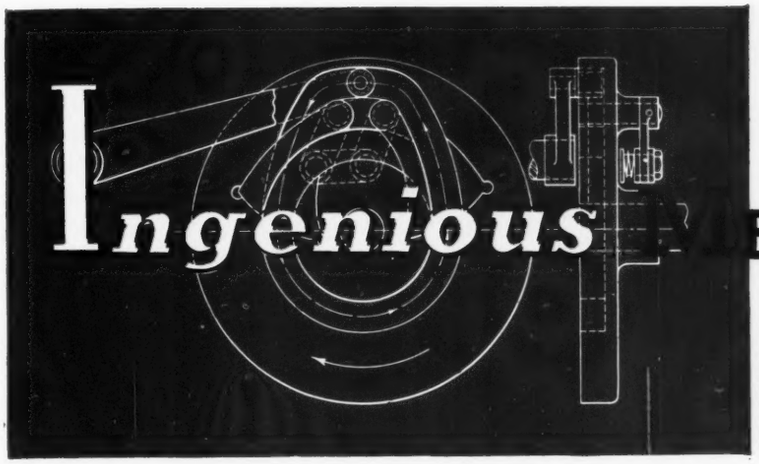
* * *

Fortieth Anniversary of Dayton Engineering Laboratories Co.

The importance of inventions and new ideas to the growth of the nation and to rising standards of living was emphasized at a recent celebration which marked the fortieth anniversary of the incorporation of the Dayton Engineering Laboratories Co. (Delco), held in Dayton, Ohio. At this celebration tribute was paid to Charles F. Kettering, General Motors research consultant; Colonel E. A. Deeds, chairman of the board of the National Cash Register Co.; William A. Chryst, retired Delco Products chief engineer; and oldtime Delco employes who worked with Mr. Kettering in the pioneering days of motorcar history.

The original company, incorporated in 1909, was started in the haymow of a barn owned by Colonel Deeds. Its first product was a relay-controlled ignition system for the 1910 Cadillac. Later, Mr. Kettering and his associates developed the first electric self-starter, which revolutionized the automotive industry.

Present officers of the Cincinnati Bickford Tool Co. (Left to right) L. Lee Schauer, vice-president and chief engineer; Ozni E. Schauer, president and general manager; George P. Gradolf, chairman of the board and treasurer; Paul E. Heckel, secretary; and Neil C. Schauer, vice-president and sales manager



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

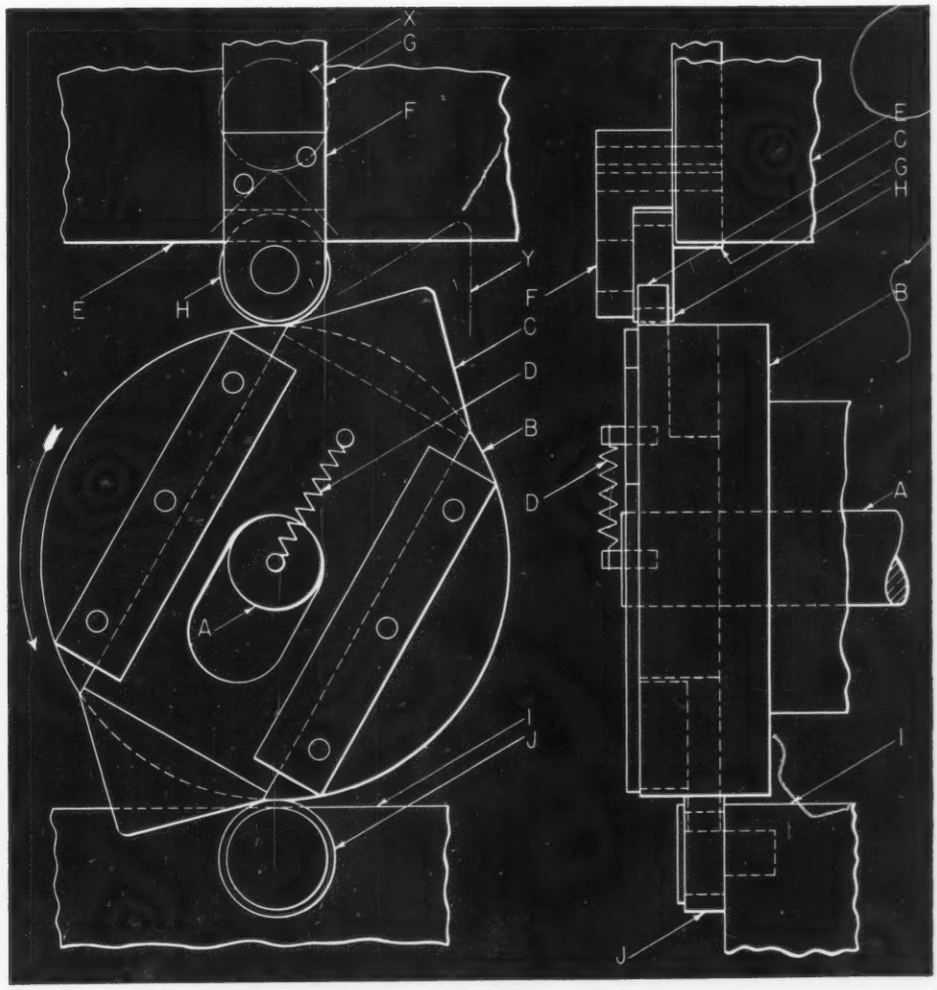
High-Lift Cam with Low Pressure Angle

By L. KASPER

Cams acting on straight-line followers are generally limited to moderate pressure angles because of the side thrust developed against the follower bars. In order to produce a high lift without excessive side pressure, the cam shown in the accompanying illustration was designed. It was applied in a wire fabricating machine.

The drive-shaft *A*, rotating in the direction indicated by the arrow, has keyed to it a cam body *B* that carries a cam-shaped bar *C*. This bar is shaped at each end to produce one-half of the total cam lift, and is a slide fit in the gibs at each side of it. A slot in the bar provides clearance for the drive-shaft, and the bar is normally held in the position shown by the spring *D*.

The follower bar *G*, mounted on the machine member *E*, carries a block *F* in which is contained a roller *H*. Another roller *J* rotates on a stud which is held in a fixed position in its support *I*. The rollers *H* and *J* are offset relative to each other, so that each one contacts only one end of the cam bar *C*, which is relieved accordingly at both ends. This arrangement prevents the occurrence of two movements of the follower bar *G* in one complete revolution of the cam.



A sliding cam bar having each end formed to produce one-half the total rise provides a high lift for the follower without excessive side thrust

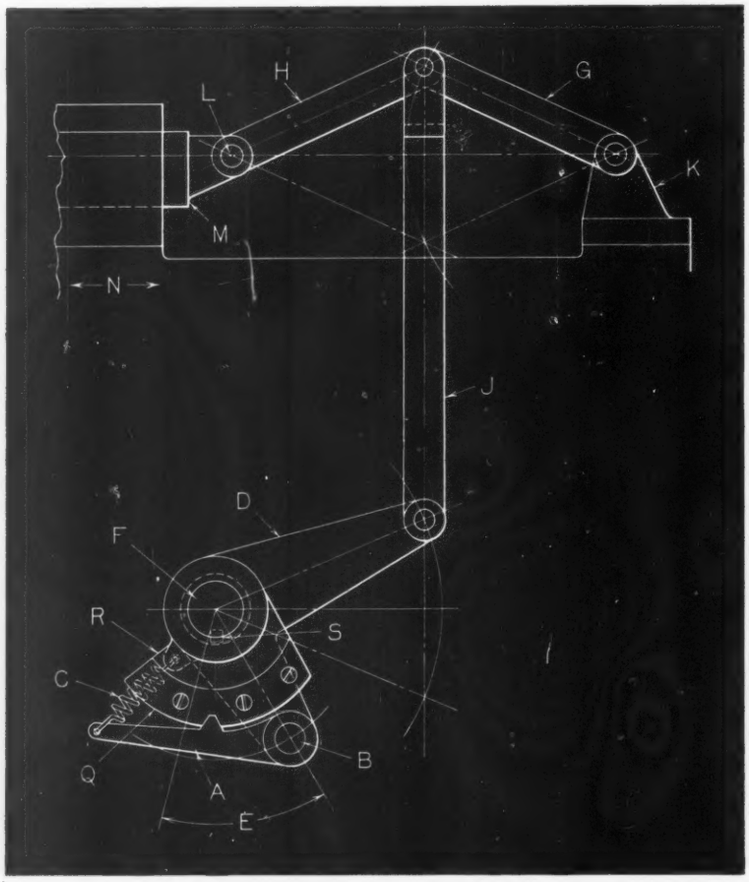
In the position shown, the follower bar is about to be raised by the upper end of the cam bar which contacts roller *H*, and the lower end of the cam bar is about to engage the fixed roller *J*, so that the cam bar will be raised at the same time that its upper end is raising the follower bar. As a result, the movement of the cam bar, added to the normal rise produced by the upper end, moves the roller *H* to the position indicated by phantom lines at *X*. To produce this lift, with a conventional cam having the total rise on one lobe, a form such as that shown at *Y* would be required.

Drive Unit with Slip Mechanism

The slip device here illustrated was designed to prevent breakage of operative members, and is an important feature of the feeding mechanisms of certain machines. It is of the jump-pawl type, the pawl *A* being designed to operate with the radial plate *Q*. Pawl *A* is free to pivot upon stud *B*, although it is normally held in the position shown by the spring *C*.

The bellcrank lever *D* oscillates through the arc *E*, being actuated by the shaft *F*. Linkage levers *G* and *H* are moved up and down by means of connecting-rod *J*. Lever *G* is attached to a non-movable block at *K*, while lever *H* is attached at *L* to a sliding member *M*. The sliding member moves backward and forward in the direction indicated by the arrow *N*, once on the up stroke of the connecting-rod *J* and once on the down stroke, thus, in effect, producing a two-cycle movement of the member *M* for each reciprocation of rod *J*.

If slide *M* becomes jammed or is prevented from moving in a normal manner, pawl *A* will ride out of the notch in plate *Q* and travel over the radial surface of this member, thus disconnecting the drive. Bellcrank lever *D* is a separate unit from the plate-carrier *R*, which is keyed to shaft *F*. Key *S* drives plate-carrier *R*, which, in turn, drives pawl *A* when it is engaged with the notch in plate *Q*. This, in turn, operates bellcrank lever *D*. H. M.



Slip-drive mechanism by means of which oscillating bellcrank (D) transmits reciprocating movement to slide (M), with provision for disengaging the drive from shaft (F) in case slide (M) becomes jammed

* * *

American Optical Co. Wins Top Safety Award

The Distinguished Service to Safety Award of the National Safety Council was recently presented to the American Optical Co. at ceremonies held in Southbridge, Mass., which were attended by the Governor of the state. The award was won by the company's New England plants for working almost three million consecutive man-hours without a single disabling injury. These plants are located in Southbridge and East Boston, Mass., Putnam, Conn., and Brattleboro, Vt.

* * *

The Government is in need of highly qualified engineers and scientists. A new file is now being accumulated in Washington which is to contain 100,000 questionnaires now on the way to professional engineers and scientists. The Scientific Personnel Branch of the Office of Naval Research has been assigned by the Secretary of Defense to be the referring office for scientific uniformed and civilian employes.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Die-Casting Die without Ejector Pins and Retractable Cores

By ARTHUR MUMPER, Cleveland Heights, Ohio

The two-cavity die-casting die shown in the accompanying illustrations was designed with a view to low-cost construction and maintenance. There are no ejector pins, and all cores are fixed, except six that produce three oil-holes in each of the cast parts, thus eliminating the necessity for ejector-pin and core withdrawing mechanisms.

This die is used to cast gear covers of aluminum alloy at the rate of 250 per hour. A 1-inch diameter center hole in each gear cover is held to a tolerance of 0.002 inch. Two 0.750-inch diameter holes are produced at one end of the parts, and one 0.625-inch diameter hole at the opposite end, to a tolerance of plus 0.001, minus 0.002 inch. Center distances between these holes are maintained within plus 0.005, minus 0.002 inch. These holes, and three 0.281-inch diameter holes in the mounting pads of each part, are produced by means of fixed cores. Oil-holes, 1/4 inch in diameter, entering the 0.750 and 0.625 inch diameter holes at an angle, are produced by means of pinion-actuated cores. An average wall thickness of 0.125 inch is maintained on the gear covers within a tolerance of plus or minus 0.005 inch.

Air-hardening tool steel, hardened to 45 to 50 Rockwell C after drawing to temper, is used for the die-block *A*, Fig. 2, in the movable section of this die, and also for the large cores *B* in the

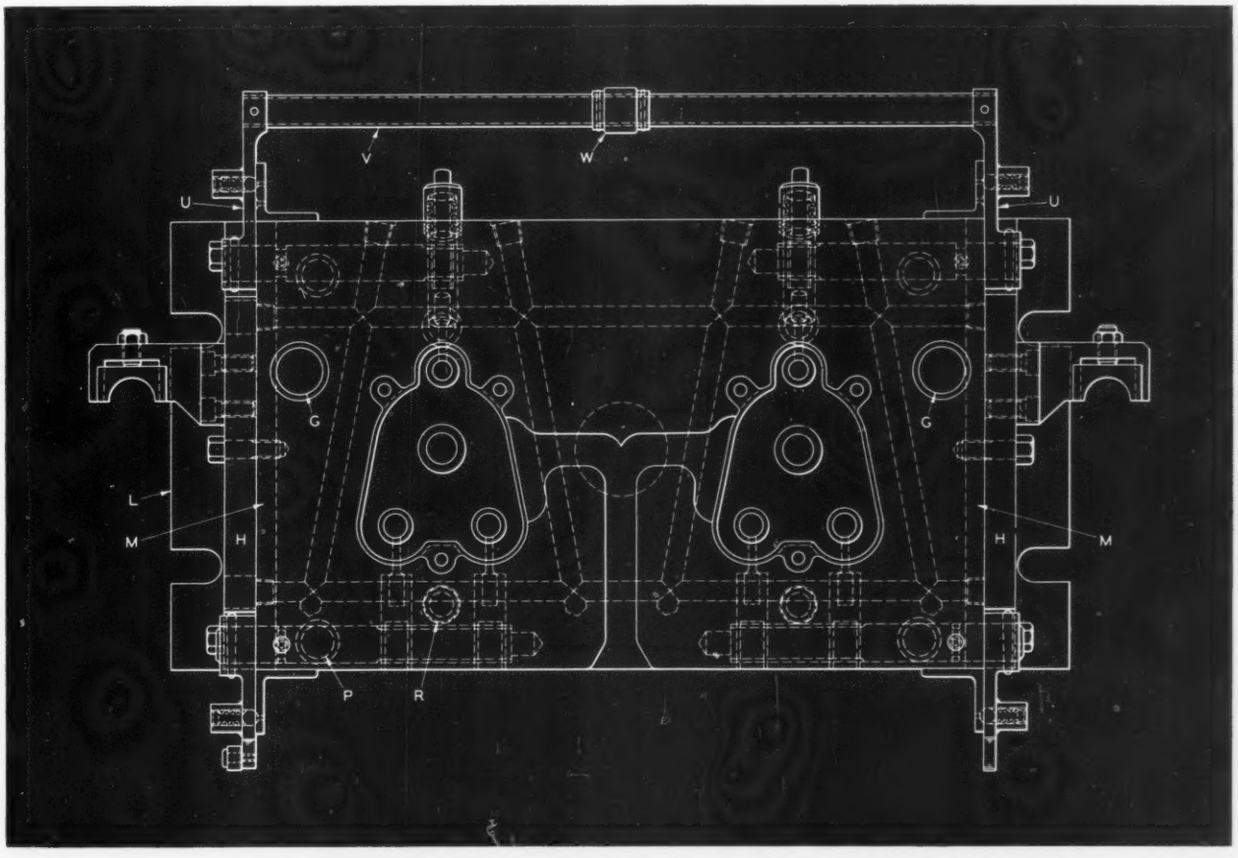


Fig. 1. End view of the movable section of a two-cavity die-casting die used for producing aluminum-alloy gear covers

stationary section. The smaller cores *C* and *D* in the movable section are made of 0.90 per cent carbon steel, hardened, ground, and polished, as are also the ejector sleeves *E*. All other parts are made of machine steel.

In operation, the two sections of the die are aligned by means of two guide pins *F* in the stationary section which enter bushings *G*, Fig. 1, in the movable die. Two side-plates *H* are attached to the die-block by means of screws that act as dowels, thus preventing the side-plates from slipping. By the same means, the side-plates are also secured to plate *K*, Fig. 2, which is fixed and contains the cores *C*. Socket-head cap-screws and dowel-pins connect a back-plate *L* to the side-plates, which are further supported by six accurately machined straps *M*, welded in place.

The cavities in the die-block are 1.500 inches deep, plus 0.005 inch, and have a side wall taper of 3 degrees to facilitate ejection. Ejector sleeves *E* are mounted in a plate *N*. This plate, guided by four short pins *P*, which are pressed into die-block *A*, remains stationary when the rest of this die section moves back to contact a stop *Q*. The relative motion produced causes the sleeves *E* to eject the parts. Four compression springs *R*, seated in the die-block, exert pressure against plate *N* to maintain its position against plate *K* when the die is closed.

The six cores *D* that produce the oil-holes are secured in holders *S*. On one side of these core-holders are rack teeth which engage pinions *T*. Levers *U* are attached to the pinion-shafts at one end. In the case of the two cores that produce oil-holes in the 0.625-inch diameter holes, the levers are secured by means of tapered pins to a seamless steel tube *V*, Fig. 1, on which is mounted a roller *W*. This roller engages stop *X*, Fig. 2, on the stationary section of the die when the movable section is almost closed. The racks and pinions are thus actuated to bring cores *D* into place for casting. When the die opens, after the casting operation, roller *W* contacts a stop mounted on an overhead bar, thereby turning the pinions in the opposite direction and withdrawing the cores before the die is back far enough for the ejection action to take place.

The levers *Y* attached to the rack and pinion mechanisms for the four cores *D* that produce oil-holes in the 0.750-inch diameter holes are connected to rollers that engage a stop-block *Z*. This throws levers *Y* both ways, and since the rollers must pass over the top of block *Z* without being

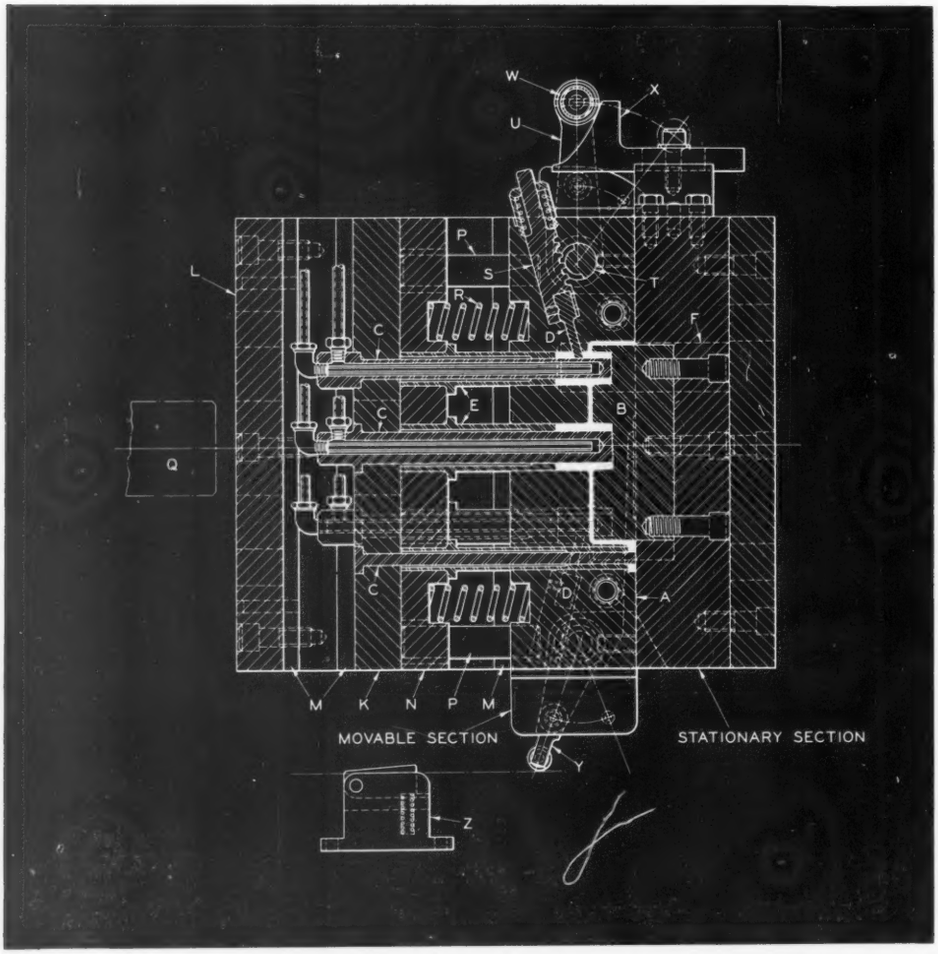
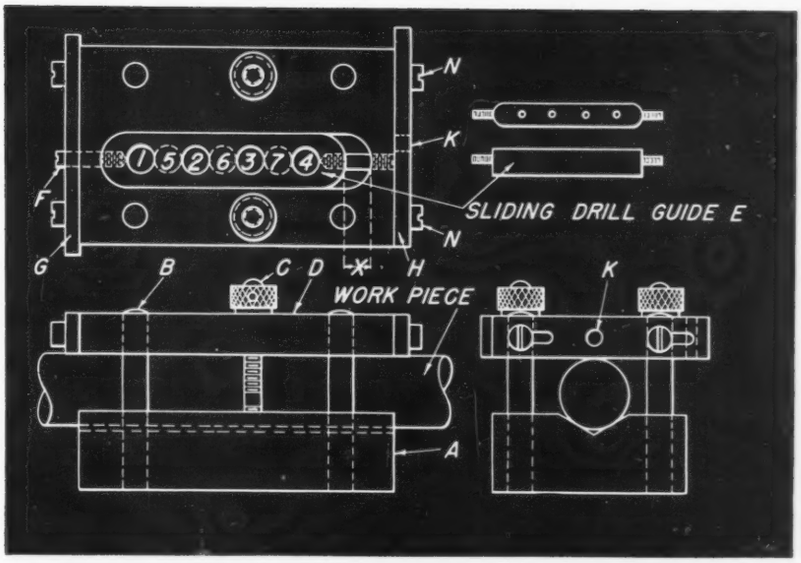


Fig. 2. Cross-section of the movable and stationary sections of a two-cavity die-casting die shown in the casting position



Slot-drilling jig that can be adapted for different sizes of slots simply by changing drill guide (E)

forced out of line, a spring is provided under a tripping pawl to permit it to be depressed. All six of these cores *D* are held in position by means of spring and ball pressure on the levers *U* and *Y*.

The die-block is water-cooled through the holes indicated in Fig. 1, and the fixed cores are provided with tubing for the same purpose, as seen in Fig. 2. Water flows from 1/4-inch inlet tubing to the end of the cores, where it backs up and leaves through 5/16-inch outlet tubing.

Quick-Acting Slot-Drilling Jig

By H. MOORE, Kirkstall, Leeds, England

The slot-drilling jig illustrated can be adapted for different sizes of shafts and slots merely by equipping it with various sizes of drill guides. It consists essentially of a base *A*, which is drilled and tapped for four guide pins *B* and two screws *C* and in which a V-groove is machined to hold the cylindrical work-piece; and a top plate *D*, which is drilled to fit on pins *B* and screws *C* and is slotted in the middle to accommodate the sliding drill guide *E*. The slot is made long enough so that the guide can be moved a distance equal to the diameter of the largest hole to be drilled.

The drill guide is located by threaded pins *F*, which are screwed into tapped holes in the guide. Slotted stop-plates *G* and *H*, held to the ends of plate *D* by flat-head screws *N*, are employed to position the guide plate; as the stop-plates are slid on screws *N*, pins *F* either stop against the plate or pass through holes *K*. Thus a series of holes can be drilled, the plate shifted, and another series of alternate holes drilled.

To illustrate the working of the jig, consider a shaft in which a seven-hole slot is to be drilled. A guide plate having four holes is mounted in the jig, and the end plates so positioned that one of the threaded pins passes through the hole in stop-plate *G*, and the other butts against stop-plate *H*. In this position, holes Nos. 1, 2, 3, and 4 are drilled. The stop-plates are then relocated and the guide plate moved a distance *X* in the slot, so that the opposite pin abuts against plate *G*. In this position, holes 5, 6, and 7 are drilled.

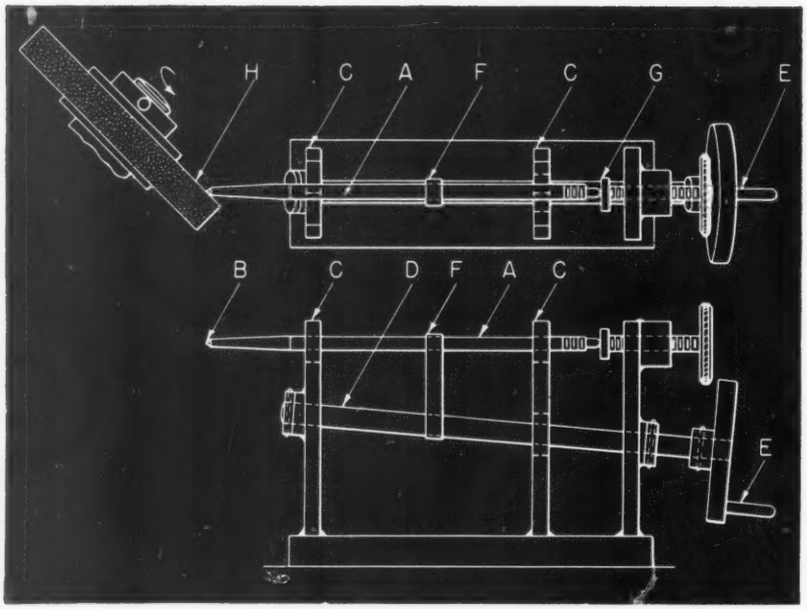
The length of the sliding drill guide and of the slot in plate *D* are the determining factors in designing the fixture. If properly designed, the base can be used in conjunction with various sizes of drill guides to drill work of various diameters. Only the guide *E* and screws *F* need to be changed for different sizes of work.

Fixture for Grinding Conical Shaft Ends Concentric with the Shaft

By CLIFFORD T. BOWER, Decatur, Ga.

Fuel valves or injector parts for Diesel engines must be perfectly concentric to insure even distribution and cut-off of fuel to all cylinders. This is particularly true of needle valves. The fixture shown in the accompanying illustration was designed for grinding the conical seat of the needle valve *A* concentric with the shaft.

The outside diameter of the valve is lapped to fit a guide sleeve with a pressure-tight sliding fit. If this diameter and the conical seat *B* are not perfectly concentric, the valve will not stop the flow of fuel and the resultant leakage will upset the engine efficiency and bring on a host of attendant troubles, such as a smoky exhaust, pre-



The conical seat (B) of valve (A) was ground by mounting the valve in the fixture shown. The valve acts as its own work-spindle, and thus insures perfect concentricity

ignition, excessive fuel consumption, and overheating of the engine.

The permissible error in concentricity between the outside diameter of the shaft and the seat is not measurable, and the best collets available for holding the valve were not sufficiently accurate. The problem was solved by using the fixture illustrated, the idea being to eliminate work-head spindles and holding devices and grind the valve by using its guide section *A* as a work-head spindle.

The guide portion of the valve rests in a pair of V-notches *C* and is rotated by turning spindle *D* with crank *E*. The connection between the spindle and the valve is a flexible flat rubber belt *F*. The inclination of spindle *D* causes the driving belt to exert a pull on the valve toward the feed-screw pad *G*, by means of which it is fed against the inclined grinding wheel *H*. Since the needle valve has a polished hemispherical head it makes point contact with the pad *G* and little friction or wear results.

As no great accuracy was required in the construction of this fixture, it was arc-welded from flat material in only a few hours. Its use, however, avoided a final lapping operation during assembly, and this saved many hours of valuable time.

* * *

Over-time pay in Great Britain customarily starts at 44 hours, with time and one-fourth for over-time. This is low, compared to the United States, where over-time usually begins after the basic work week of 40 hours, and is at a rate of time and one-half. Adult male workers in Great Britain average 46.7 work hours per week.

Ex-Cell-O Corporation Celebrates Thirtieth Anniversary

The Ex-Cell-O Corporation, Detroit, Mich., is celebrating this year the thirtieth anniversary of the founding of the company. Early in 1919, some employes of the Ford Motor Co. and others met in the home of Phil Huber with the view of organizing a machine shop that would bring new standards of precision to the manufacture of various metal parts. On July 10 of that year the Ex-Cell-O Tool & Mfg. Co. was organized.

Starting on the second floor of a small two-story building on Beaubien St. in Detroit, with a floor space of 2375 square feet, the business has grown to such proportions that it now occupies four plants having a total floor space of nearly a million square feet. The first products of the company were drill jig bushings, small jigs, fixtures, and dies, and production parts for larger manufacturers, but the business rapidly expanded to take in other lines, which now include precision boring machines, precision thread grinders, lapping machines, special machines, precision grinding spindles, hydraulic power units, aircraft and production parts, cutting tools, etc.

By 1929, the production of precision aircraft parts had become such an important part of the business that the name Ex-Cell-O Aircraft & Tool Corporation was adopted. Again, in 1937, owing to the widely diversified line of products manufactured, the company name was changed to Ex-Cell-O Corporation. The president and general manager of the concern is Phil Huber—one of the founders and a member of the board of directors from the beginning.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

How Can This Buttress-Thread Part Best be Produced?

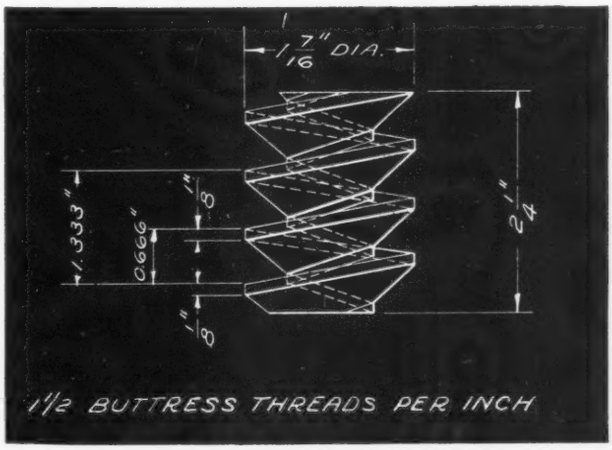
A. H. B.—The cold-rolled steel part with buttress thread shown in the accompanying illustration is to be made in lots of 10,000 to 50,000 pieces, after which the parts are to be casehardened. Suggestions as to whether they can be made most efficiently by thread rolling, grinding, or milling will be appreciated.

Answered by W. P. K.

The method of producing the buttress thread shown would depend largely upon the angles, for which there is no recognized standard for buttress threads. In the illustration, it looks as though one side was straight, which would be very difficult to produce economically under any conditions. The thread is too coarse to be rolled in the cold state, and I doubt if it could be rolled hot. The degree of accuracy required would have to be known, and I imagine that the customer would probably end up by cutting with a special large Landis die-head or milling, depending upon the accuracy desired.

Answered by George Hughes

Assuming the buttress thread illustrated has a 45-degree thread angle, the root diameter is only 0.606 inch. Since the pitch of the thread is large in proportion to the diameter, milling of the thread—because of the small torsional strain produced — would probably be the most efficient means of producing this part. By this method, a high rate of production can be obtained with a single cutter, which is particularly adaptable to coarse pitches such as this, inasmuch as only a small amount of metal is removed by each cutting edge around the circumference of the cutter during one revolution.



Considering the material and the lack of close tolerances, it can safely be assumed that the accuracy and finish obtained by thread grinding will not be required for this job. Although the highest rate of production can be obtained by thread rolling, and the quantities involved indicate that dies can be made economically, the hard surfaces produced by this method are of no advantage, since the part is to be casehardened after forming the thread.

Liability of Carriers for Damage to Machinery in Transit

A.K.B. — A railroad refuses to pay for damages to a machine occurring during transit. It is claimed that the damage was caused by our carelessness in packing and securing the machine. Can the railroad refuse to pay us?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

It is a well established law that a common carrier is not liable for damage to a shipment caused by fault of the shipper. In Boh Brothers Construction Co. vs. Perry Heavy Haulers [166 Fed. (2d) 719], it was shown that a company shipping a machine by freight did not fasten it securely to the flat car on which it was loaded. The machine was damaged during transit and the shipper sued the carrier for damages.

The higher court refused to allow any damages, saying: "Injury to the machine occurred through the fault of the plaintiff (shipper), in improperly preparing the machine for shipment, and the damage having thus been sustained through the act and fault of the shipper, the carrier is not liable."

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER Sales Engineering Consultant

The Approach to a Prospect

MOST of us, as shop equipment salesmen, are inclined to approach a prospect from the viewpoint of the equipment we sell rather than from that of his problems. Recently, the head of a leading machine tool distributing concern illustrated this principle in a simple but forceful way as follows:

Mrs. Johnson—a housewife—had thought about buying an electric range for her kitchen. One day she stepped into an electrical appliance store. A salesman greeted her, led her to a range on display, and explained every detail of construction and operation. She listened attentively and was interested, but finally told him she would think the matter over.

Mrs. Johnson then visited another appliance store, expressed her interest in an electric range, and was greeted by another salesman. His approach was like this:

"Good morning Mrs. . . . ?"

"Mrs. Johnson," she replied.

"Yes, Mrs. Johnson, how do you do your cooking now?"

"Oh, on an old Burnside range—it's the Economy model. It's a coal range," replied Mrs. Johnson, rather apologetically.

"Why, my mother cooked with an old range like that, Mrs. Johnson. It was a grand old range. I bet you make wonderful pies in it—don't you?"

"Perhaps I do," admitted Mrs. Johnson, blushing.

"Do you do all of the cooking, yourself, Mrs. Johnson?"

"Yes, except when my daughter helps me—she's fifteen."

"You're lucky to have a fifteen-year old daughter, Mrs. Johnson. I have a thirteen-year old girl. She helps her mother. Isn't it fine to have the young folks help?"

"It surely is," replied Mrs. Johnson enthusiastically.

Talking together, the salesman led Mrs. Johnson over to the range on display. But his attention was still fixed upon her. It is true he demonstrated the range, but each sales point that he made started with Mrs. Johnson, and not with the range.

"Sometimes my mother put a pie in the oven and forgot all about it. Maybe you've done the same Mrs. Johnson?" Such was his approach to the automatic control, rather than starting with the automatic control system itself.

Here is an example of clever selling of production equipment for the home. The same method is applicable to selling equipment for the industrial plant. The first salesman used the "product approach." The second salesman, studying his prospect, placed himself in her position and based his selling on her interests and the results she would get from the use of the new range. His was a "prospect approach."

The principle illustrated is at the very root of successful shop equipment selling. It consists of establishing a relationship with the prospect at his level, understanding his problems and interests, and becoming a part of his accomplishments and success. Most of us know and like the tool we sell. It is easy to talk about the design and operation, allowing the prospect largely to interpret and apply those results for which he may have a particular interest. One factory superintendent may have his mind on greater precision, another upon higher production, and so on. The president of the company usually has a broader viewpoint. His interest is the overall return, compared with the cost of investment.

The salesman need not disregard all the selling features of his machine. What he must do is to focus on those features that have a personal appeal to the prospect. After all, machine tools and allied equipment represent "end values"—those that benefit the individual prospect according to *his* interests!

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Thompson "Truformatic" for High-Speed Contour Grinding of Small Parts

A new "Truformatic" crush-form grinding machine has been developed by the Thompson Grinder Co., Springfield, Ohio, for grinding simple or intricate contours on small metal parts at production rates up to 4000 pieces per hour. The machine shown in Fig. 1 is set up to finish-grind convex and concave edges on lock stampings. About 160 stampings are loaded into a fixture as shown in the view to the left in Fig. 2. The loaded fixture is then placed in the idle station of the indexing table, two fixture-holding stations being provided to permit loading and unloading during the grinding or operating cycle.

The automatic operating cycle is started by pressing a button. The table indexes 180 degrees, carrying the work into position for grinding. This indexing movement also brings the fixture with the finished work on the other side of the rotating table back to the idle position for unloading and refilling with new work while the automatic cycle continues.

Completion of the automatic cycle consists of feeding the wheel-head to depth; raising the

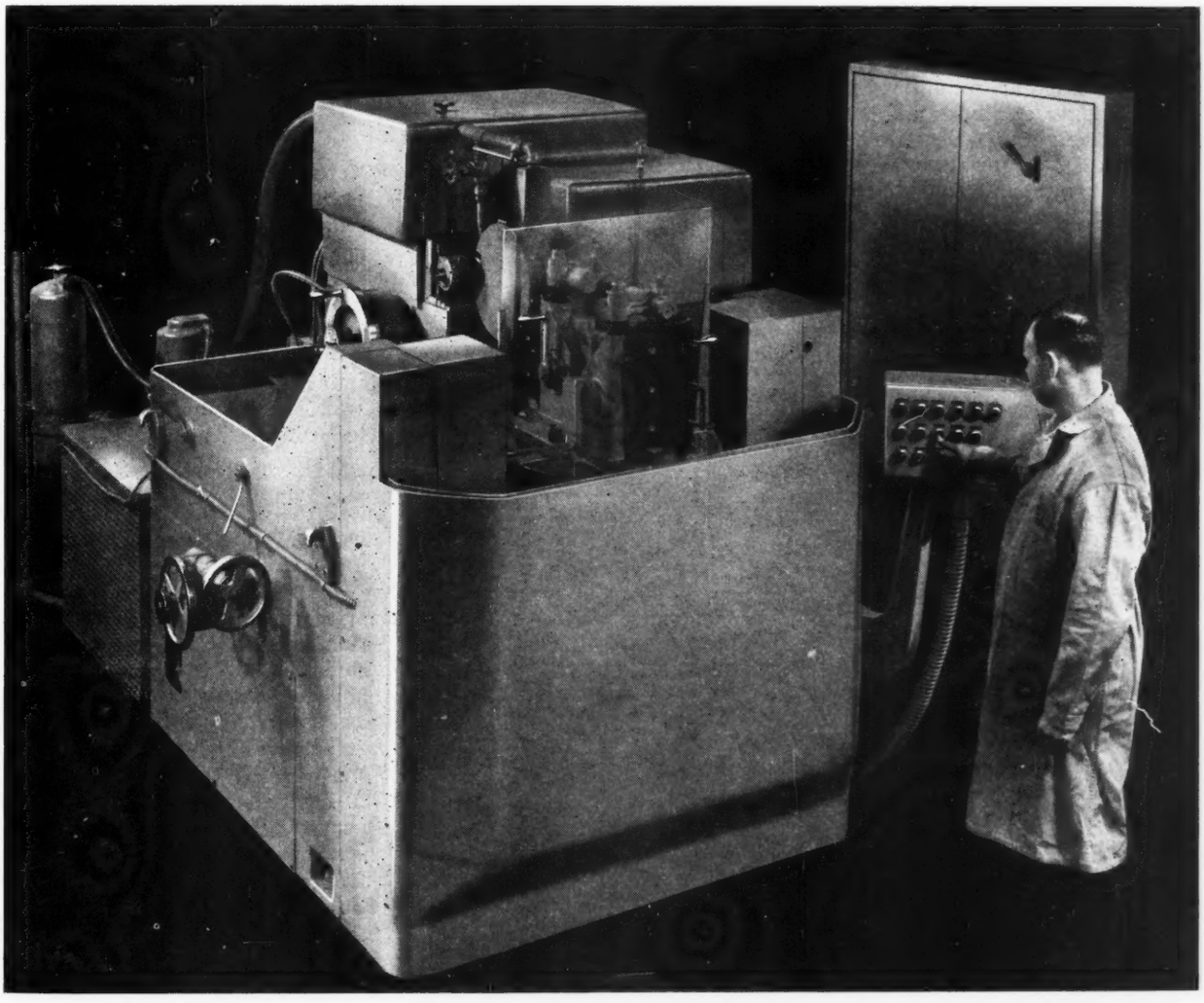


Fig. 1. "Truformatic" contour grinding machine developed by the Thompson Grinder Co., with completely automatic operating cycle and push-button control

To obtain additional information on equipment described on this page, see lower part of page 228.

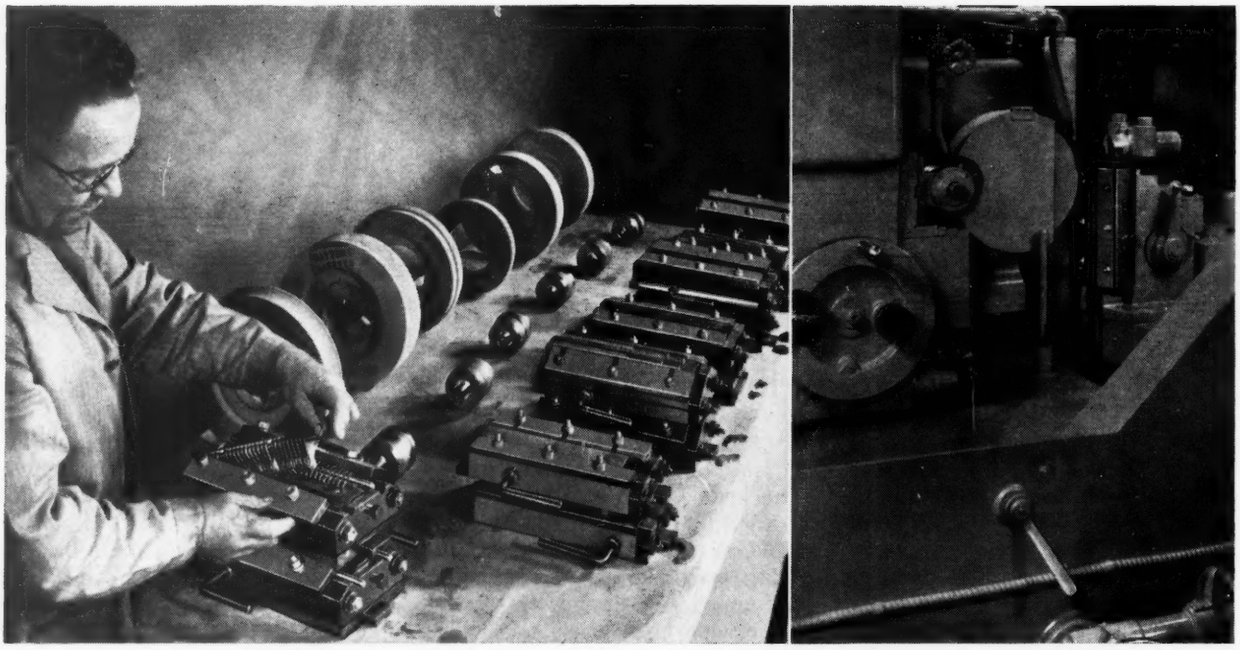
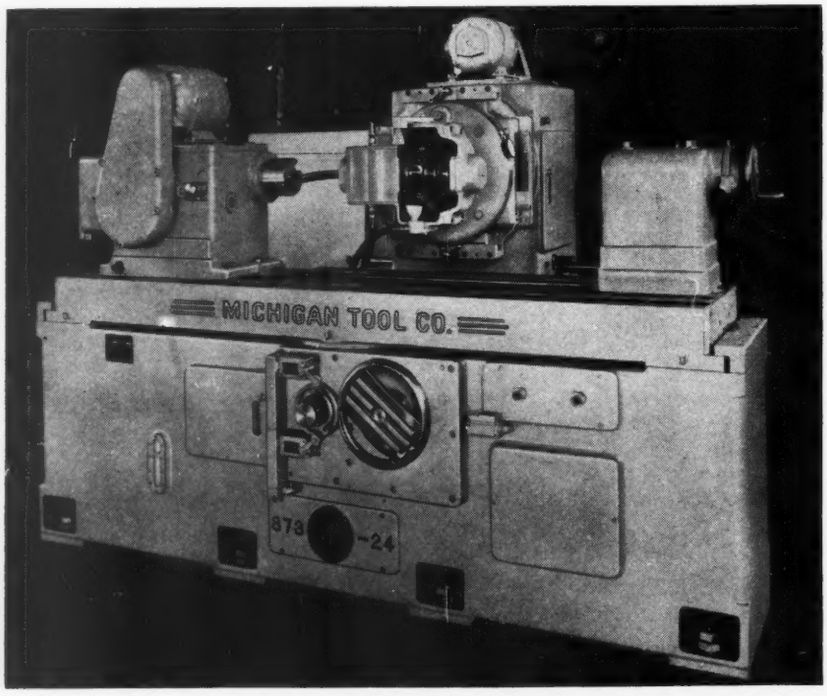


Fig. 2. (Left) View showing operator loading "Truformatic" fixture with 160 small stampings. Other parts with their respective fixtures and master contour crusher-rolls and grinding wheels with contours formed by the crusher-rolls are shown in the background. (Right) View of "Truformatic" grinder showing the master crusher-roll at the rear of the grinding wheel and the position of the work-table and fixture before starting the grinding operation

work-table to complete the contour-grinding operation with a preset length of stroke and feed; withdrawing the wheel-head at the top of the upward stroke of the table; returning table to down position; and indexing table 180 degrees to starting point.

The view at the right in Fig. 2 shows clearly how work in the fixture is brought into contact with the grinding wheel. After the original setting is completed, the operation becomes entirely automatic. The work is ground in a single pass as the form is transferred from the wheel and ground into the metal parts. The work-table stroke is variable from 3 to 16 inches. 61



Michigán rotary gear-shaving machine designed to handle heavy-duty gears

Michigan High-Production Gear-Finishing Machine

The Michigan Tool Co., 7171 E. McNichols Road, Detroit 12, Mich., has brought out a new gear-shaving machine for finishing heavy-duty gears. This Model 873 machine, which is available in two sizes, is completely automatic in operation. It will handle spur or helical gears and involute splines of any size from 0 to 18 or 24 inches in diameter and up to 15 inches face width. Once the machine is set up for a given type of gear, it is only necessary to load the gear between centers and push a "start" button to complete the entire operation.

In addition to automatic operation for production-line installation, outstanding new features include ability to shave gears by any of three methods known as "underpass"; "transverse" or "traverpass"; ability to curve-shave or crown wide-faced gears, if desired, as well as narrower gears; greatly reduced floor space; all controls located at the front of the machine; faster cutting, due to inclusion of a rapid approach feed in the machine cycle and automatic in-and-return feed; and special interchangeable cutter-head for finishing internal gears. 62

To obtain additional information on equipment described on this page, see lower part of page 228.

DoAll "Contour-matic" Designed to Handle Wide Range of Work

Automatic operation in performing rapid repetitive precision cutting on a wide range of production work is an outstanding feature of the new "Contour-matic" announced by the DoAll Co., Des Plaines, Ill. This band-saw type machine will perform cutting and filing operations on a large variety of metals and non-metallic materials. It has a throat depth of 20 1/4 inches and a work thickness capacity of 12 inches. Saw blades 164 inches long and from 1/16 to 1 inch wide, and files 162 inches long, in 1/2-, 3/8- and 1/4-inch widths, are available.

The wheels on which the endless saw blade or file is mounted are 21 inches in diameter by 1 1/4 inches wide. They are of balanced cast-aluminum alloy construction, with Neoprene corded tires. The upper wheel has a hydraulic tension adjustment range of 3 inches, making it possible to use saw bands with a total variation in length up to 6 inches.

A four-way valve, operated by the band adjustment knob shown in the lower right-hand corner of the control panel in Fig. 2, governs the up and down adjustment of the upper wheel assembly, while the band control knob in the upper right-hand corner actuates an adjustable relief valve in the hydraulic circuit which can be set to maintain the proper tension on the saw blade. A gage above the tension control knob shows the pressure exerted at all times.

An accumulator arrangement serves to maintain a small amount of tension on the band for several hours after the power is shut off, thus keeping the band under tension while setting up or making adjustments. Provision is also made for automatically stopping

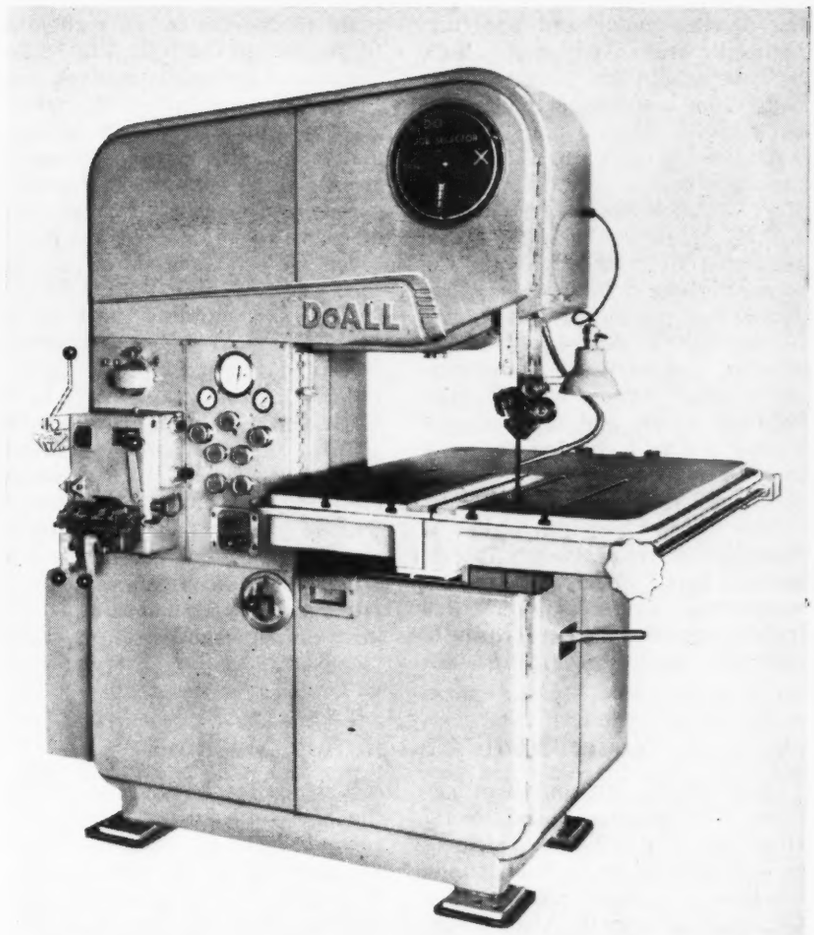


Fig. 1. (Above) "Contour-matic" with hydraulically operated, panel-controlled automatic saw-blade tension arrangement, band wheel brakes, and table positioning and feeding movements

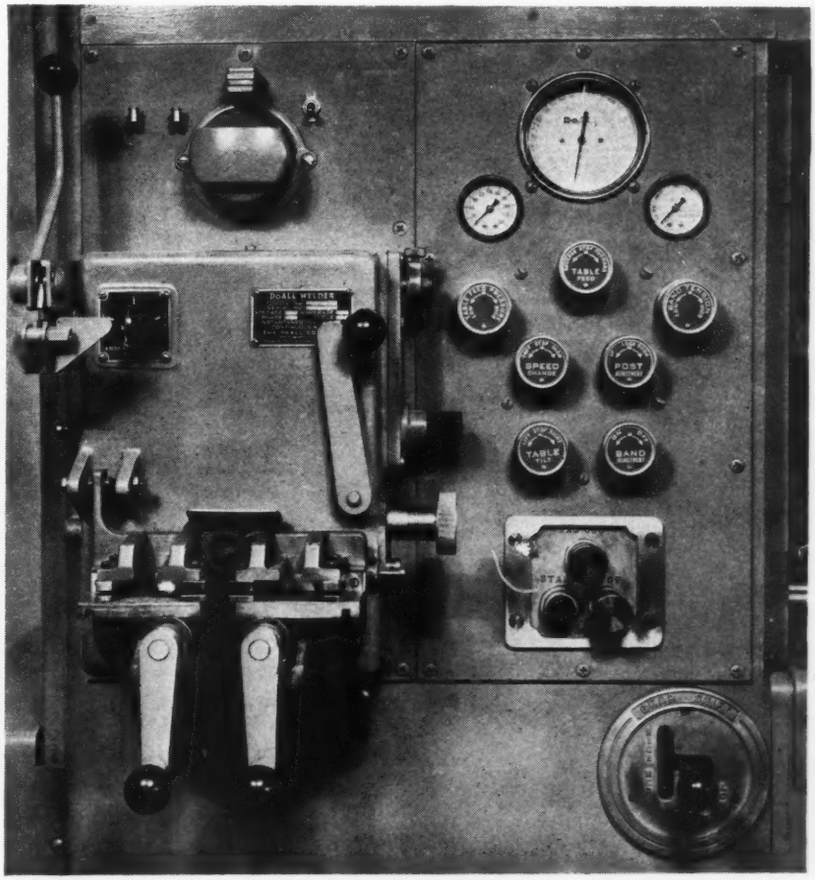


Fig. 2. (Right) Close-up view of the "Contour-matic" control panel developed to permit systematic operation by apprentices or unskilled labor for high-production cutting operations on a practically automatic basis

To obtain additional information on equipment described on this page, see lower part of page 228.

the driving motor and applying hydraulic brakes, which stop both band wheels in less than two seconds from a speed of 10,000 feet per minute.

The machine is regularly furnished with a three-phase, 7 1/2-H.P., 220-volt, 50-60 cycle, 1750-R.P.M. motor. Cutting speeds, regulated hydraulically from the operating panel, range from 40 to 10,000 feet per minute. The drive is through a three-speed transmission and variable "Speedmaster" pulley device with V-belts between motor and transmission having a 6 to 1 driving ratio. A tachometer type indicator gives the speed in feet per minute.

The heavy cast-iron table is 2 1/4 by 32 by 41 inches in size, and has four T-slots. Its top work-supporting surface is 39 3/4 inches from the floor. Hydraulic controls facilitate tilting the table 45 degrees to the right and 10 degrees to the left. The table, also under hydraulic control, has a feeding movement of 16 inches. The hydraulic feed can be adjusted for any desired pressure from 0 to 30 pounds. The correct speed, feeding pressure, and type of blade to be used in cutting a given material are shown on the "job selector" dial.

The saw guiding post is of 1 1/4- by 2 1/4-inch ground steel and is raised, lowered, and locked hydraulically. An automatic flash welder is provided for joining the ends of saw blades, which has a blade shear mounted on it for cutting off blades. A built-in grinder motor is also provided for welder flash dressing.

The machine requires a floor space of 70 by 72 inches, is 78 3/4 inches high, and weighs 3000 pounds. 63

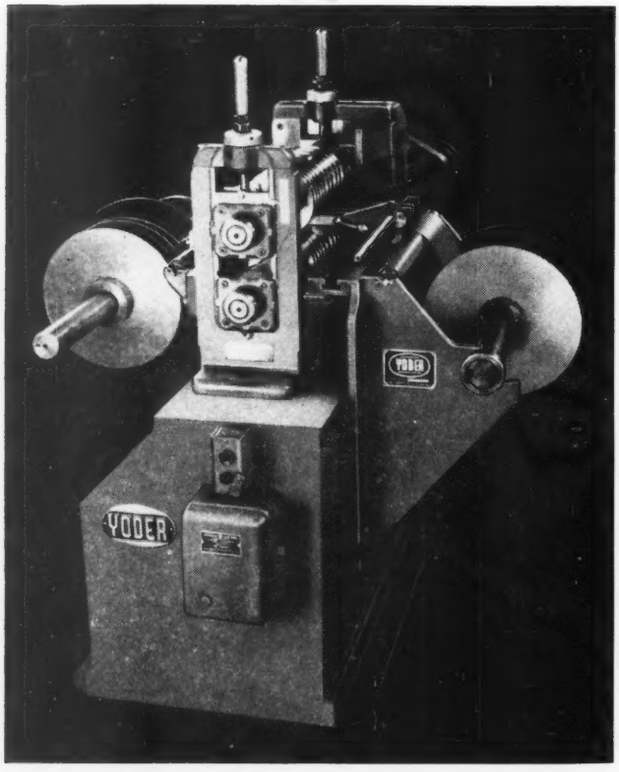
Yoder Small Coil-Slitting Machine

A completely self-contained machine for slitting coiled metal stock up to 0.062 inch thick in coils weighing up to 250 pounds has been brought out by the Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio. This machine is equipped on the entry side with a coil-holder for unwinding, and on the exit side with a recoiler for rewinding the slit strands. Sleeves are provided for the recoiler shaft to permit rewinding strands into coils of different core diameters. The machine operates at a slitting speed of 150 feet per minute.

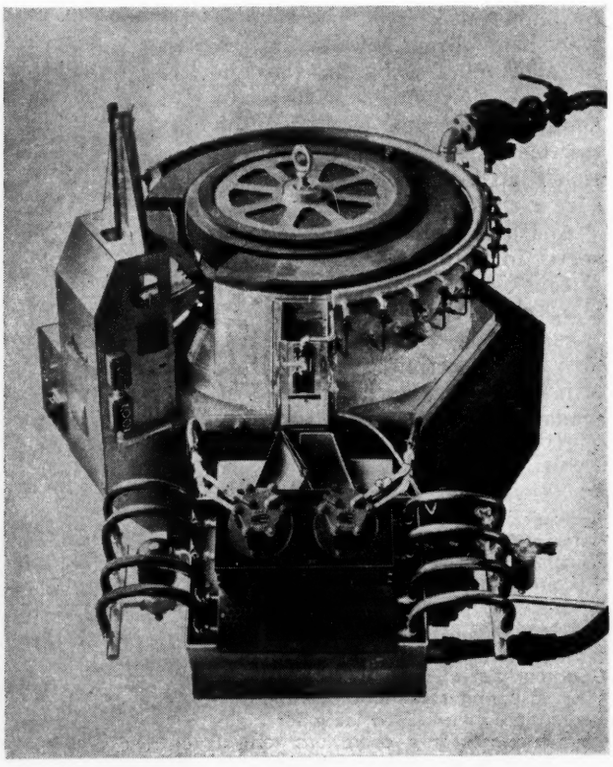
The table on the entry side of the machine is bolted to the side of the base and is adjustable vertically to maintain the strip in line with cutters of any diameter between 5 and 8 inches. Side guides are provided which are adjustable for different strip widths. The slitter has alloy-steel cutter-arbors, which are surface-hardened and ground, and micrometer dial screws for quick and accurate adjustment of the top arbor and maintenance of parallelism. 64

Automatic Radiant Gas Hardening Machine for Automotive Plates

Automotive plates can be hardened and quenched at the rate of 800 per hour on a new radiant gas machine brought out by the Selas Corporation of America, Erie Ave. and D St., Philadelphia 34, Pa. The loading arm of the machine places the pieces on the rotary refractory hearth, which moves past a series of twenty-four radiant ceramic gas burners, advancing the pieces as required to maintain the predetermined temperature. At the end of the cycle, the nickel-chrome alloy ejector arm throws the pieces into



Small self-contained coil-slitting machine brought out by the Yoder Co.



Selas radiant gas machine for hardening automotive plates

To obtain additional information on equipment described on this page, see lower part of page 228.

the quench chute which is provided with baffles that alternately deliver the heated pieces into quenching chambers, two of which are provided because of the rapid rate at which the pieces are heated.

Limit switches control the operation of the unloading arm, quench chute baffle, opening and closing of the quench dies, and water injection. Premixed gas and air are supplied to the machine at constant pressure by a Selas combustion controller. The machine is also equipped with a Selas fire check. Although developed specifically for hardening automotive plates, this machine is adaptable to a large number of heating and heat-treating operations. 65

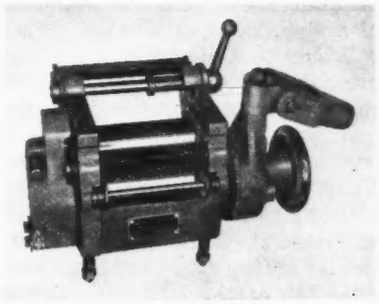
Moak Metal-Cutting Band Saw

A high-speed band saw with a heavy-duty four-speed transmission providing operating speeds of 150 to 1200 R.P.M. for cutting metals and alloys is being manufactured by the Moak Machine & Tool Co., Port Huron, Mich. The wheels and motor have prelubricated and factory-sealed bearings, which eliminates the need for periodic lubrication and the danger of over- and under-lubrication of these units. New two-wheel equalized brakes serve to stop the wheels smoothly in a few seconds when the brake pedal is depressed, and stop the wheels automatically in case a blade breaks. 66

"Roto-Flame" Gas-Fired End-Heating Furnace

An entirely new type of end-heating furnace has just been introduced by Gas Appliance Service, Inc., 1211 Webster Ave., Chicago 14, Ill. It is claimed that this furnace will heat work at an exceptionally fast rate and practically without the formation of scale. These advantages are largely attributed to high manifold pressures, a small combustion chamber, and the design of the chamber itself.

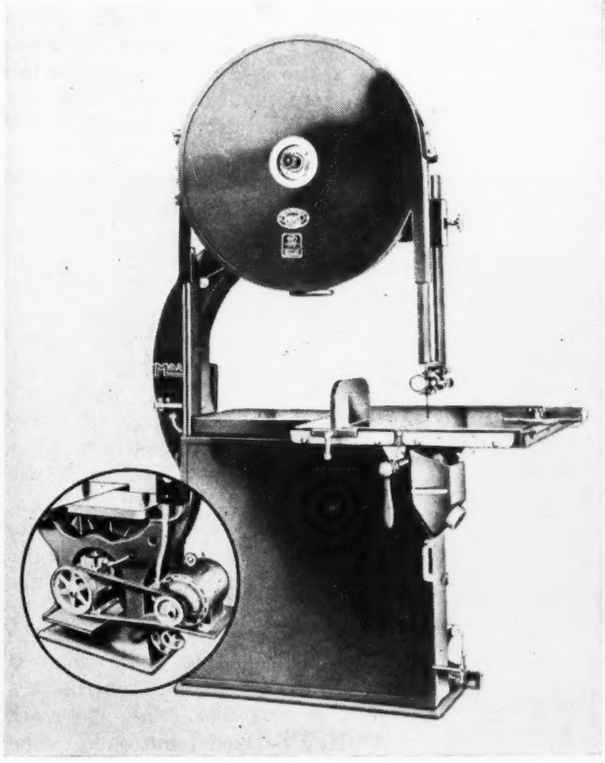
The furnace is adapted for use in forging, swaging, upsetting, threading, hardening, and annealing operations. The ends of the pieces being heated are entirely enclosed by the flame. These furnaces are available in several different sizes and lengths, and can be furnished with or without a conveyor. 67



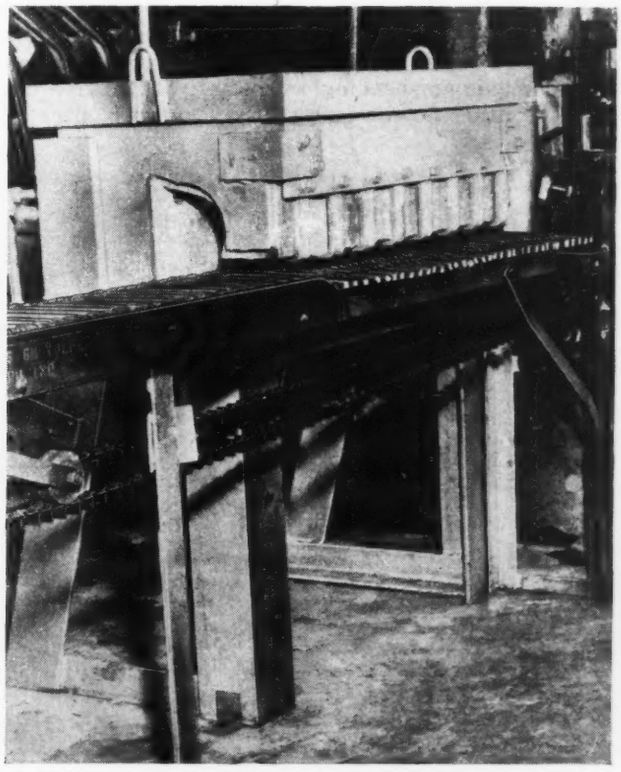
Roll feed equipped with automatic starting and roll-release mechanism made by U. S. Tool Company, Inc.

Roll Feed with Automatic Starting and Roll-Release Mechanism

The U. S. Tool Company, Inc., Ampere (East Orange), N. J., has incorporated a new feature in its roll feeds, comprising an automatic starting and roll-release mechanism. With this device applied to the roll feed as shown in the illustration, the operator can raise the upper roll of the feed into a locked position by means of the ball type handle at the upper right-hand side of the roll frame, leaving both hands free to move the stock through the roll feed and into the die, where it can



Metal-cutting band saw placed on the market by the Moak Machine & Tool Co.



Gas-fired end-heating furnace introduced by Gas Appliance Service, Inc.

To obtain additional information on equipment described on this page, see lower part of page 228.

be located by sight or by means of a stop.

When the operator trips the press and the ram descends, the rolls will not start feeding the material immediately, as the upper roll is in the open position. Upon the continued downward motion of the ram, as the punches enter the stock, the trip extension located on the ram hits the release cross-bar on the feed, causing the upper roll to be released and returned to the feeding position. When the ram ascends and the punches clear the stock, the roll feed is resumed on the up stroke of the ram. 68

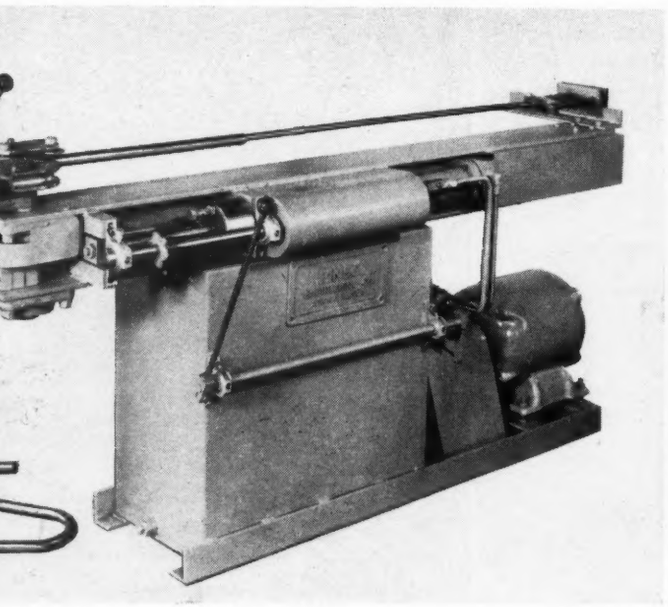
Pines Semi-Automatic Tube-Bending Machine

A completely self-contained semi-automatic hydraulic bending machine, designed for speedy handling of production jobs or short-run and maintenance bending work requiring frequent changes in set-up, has been added to the line of the Pines Engineering Co., Inc., Aurora, Ill.

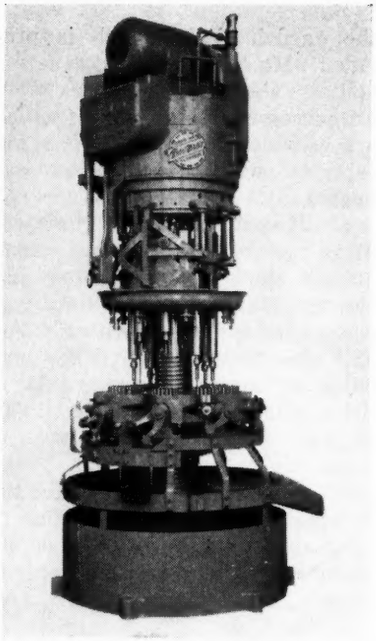
The new semi-automatic machine shown in the illustration, designated the Series 1400 bender, is designed to handle tubes and pipes up to 5 feet long, but can be easily extended to take tubes of any length. It has a maximum rated capacity for 1-inch outside diameter 16-gage steel tubing, with a maximum bending radius of 8 1/2 inches to the center line of the tube. The machine can be easily tooled to handle serpentine and stacked coil bends, and besides bending tubing, pipes, and bars, can be easily adapted for rolled or extruded sections.

The movements of the machine members are controlled by two toggle-operated hand-clamping levers and one manual hydraulic-valve control lever. An adjustable turret permits easy, instantaneous selection of any one of four preset angles of bend. The production ranges from 100 to 400 bends per hour, depending upon the size and length of material and the number of bends to be made.

The bender is mounted on a welded steel pedestal, 18 by 40 inches, which serves as a reservoir for the hydraulic oil and as a base for the motor, Vickers pump, and control valves. The over-all floor space required is 3 by 7 feet. A 5-H.P. motor drives the hydraulic pump. The complete machine weighs 1000 pounds. 69



Pines semi-automatic tube-bending machine



"Roto-Matic" valve-guide drilling and reaming machine built by the Davis & Thompson Co.

Davis & Thompson Valve-Guide Drilling and Reaming Machine

A "Roto-Matic" eight-spindle vertical continuous drilling machine manufactured by the Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis., has recently been equipped with eight twenty-station automatic indexing type fixtures designed for reaming two sizes of intake and exhaust valve guides, the larger of which has a hole 5/16 inch in diameter by 3 1/4 inches long. After the operator fills the stations of the loading magazine with valve guides, the machining and ejecting cycle is performed automatically. Any number or all of the twenty stations can be loaded at any point in the operating cycle of the machine.

As the fixture passes the loading station, the loading magazine is automatically indexed and the valve guide drops through to a stop, where it is located in a vee and clamped by a screw-actuated sliding jaw. The reamer is then fed through the work by means of a feed cam while the machine table is rotating.

On the completion of the reaming operation the return cam withdraws the spindle to its starting position. At this point, the valve guide is unclamped automatically. The stop is then automatically retracted through the action of a star wheel, permitting the machined piece to pass into the ejection chute, after which the stop is returned to its former position by a spring.

While these fixtures are of the indexing type, no extra time is required for indexing, as this operation takes place while the work is being carried from one station to the next. Production is at the rate of 2520 pieces per hour. 70

To obtain additional information on equipment described on this page, see lower part of page 228.

Gusher pump made by the Ruthman Machinery Co.

Ruthman Gusher Pump

A new motor-driven gusher pump, known as Model UD-8110, has been brought out by the Ruthman Machinery Co., 1807 Reading Road, Cincinnati 2, Ohio. The features include a large multiple inlet cast into the upper section of the impeller housing; independent flanged vertical tubular housing between motor and impeller housing; and provision for ample clearance between motor and vertical discharge pipe. This construction permits the use of special alloy castings for impeller and impeller housing when specified. It also facilitates the provision of a special length tubular housing to meet various submergence requirements.

The standard pump is made of cast iron, but it can be furnished in stainless steel, bronze, aluminum, and lead antimony alloy. The shaft is available in standard cold-rolled or stainless steel, making the pump applicable for acids, alkalies, and other liquids. The regular driving motor is totally enclosed, drip-proof, and provided with large conduit box and precision prelubricated ball bearings. An explosion-proof motor can be supplied if desired. The capacity is 25 gallons per minute at a 15-foot head, 30 gallons per minute at a 13-foot head, and 40 gallons per minute at a 10-foot head, with 1 1/4-inch discharge pipe, using a 1/4-H.P., 1725-R.P.M. motor. 71

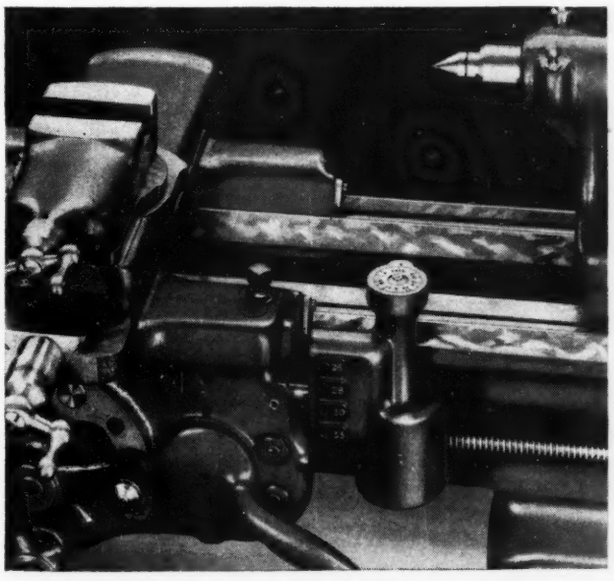
Metric-Thread Dial Indicator for Lathe

A thread dial indicator designed especially to facilitate cutting metric screw threads on lathes equipped with metric lead-screws has been brought out by the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind. This attachment is designed to save time when cutting long metric screw threads. Instead of having to reverse the lathe to return the cutting tool to the starting point, the indicator permits the half-nuts to be opened and the carriage returned quickly by hand. The graduated dial shows when to engage the half-nuts so that the tool will follow the original cut.

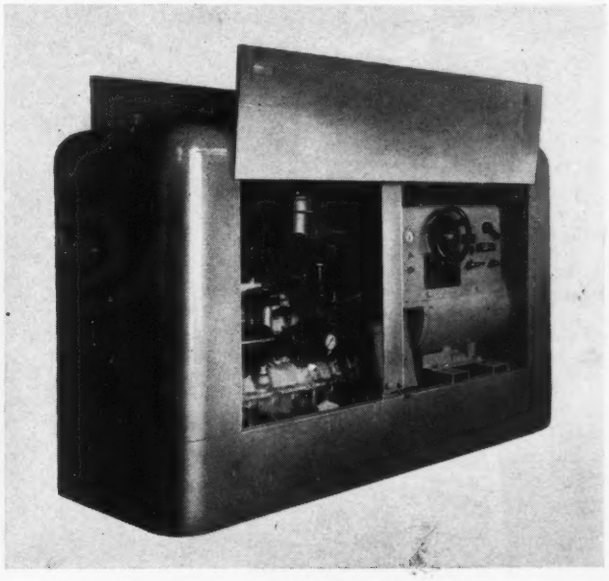
Several gears having different numbers of teeth can be mounted on the lower end of the thread dial shaft to accommodate metric screw threads of various pitches. Each graduation on the dial is marked with a letter indicating the points at which the half-nuts may be engaged for certain threads. A chart is also supplied to show which gear and which graduations must be used for each pitch of metric screw thread. The indicator is available for 9-inch swing South Bend lathes having metric lead-screws. 72

Airco Heavy-Duty Arc-Welder

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y., has announced a new direct-current 40-volt variable-voltage generator heavy-duty arc-welder known as the Wilson 36A "Yellow Jacket." This machine is built in 300- and 400-ampere sizes, and is adapted for pipe-line work, construction jobs, or any work where ruggedness and durability are important. Simplified control of current output is obtained through a handwheel on the control cabinet. Close calibration of dial eliminates the need for meters.



Metric-thread dial indicator for lathes brought out by South Bend Lathe Works



"Yellow Jacket" heavy-duty arc-welder announced by the Air Reduction Sales Co.

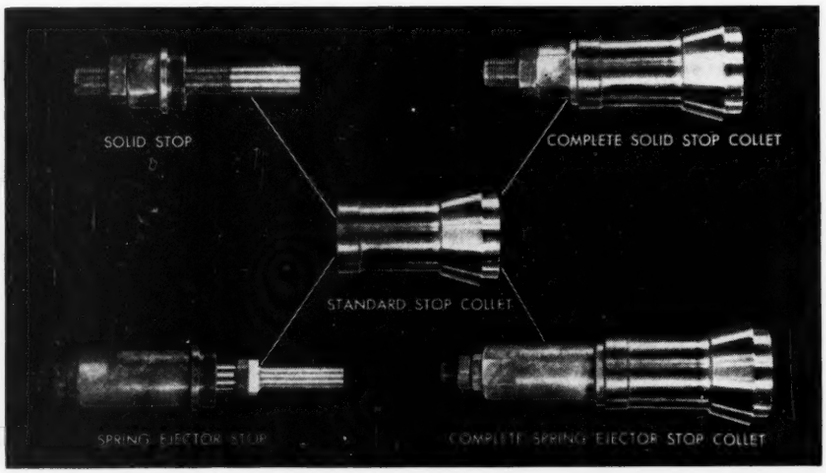
To obtain additional information on equipment described on this page, see lower part of page 228.

This welder is driven by a six-cylinder industrial engine, and is available in stationary or portable models. It is 76 inches long, 28 inches wide, and 49 inches high. Optional equipment includes a trailer for use with the portable model. 73

Shop or Tool-Room Furnace

The Sunbeam Stewart Industrial Furnace Division, Sunbeam Corporation, 4433 Ogden Ave., Chicago 23, Ill., has recently announced changes in its shop and tool-room furnace that adapt it for a wider variety of metal heating processes. The new inverted muffle section permits the furnace to be quickly converted from semi-muffle to full-muffle operation for atmosphere hardening. A removable plug is now provided to permit center heating of long bars. The unit operates over a temperature range of 300 to 2400 degrees F. The design of the new combustion chamber and nozzle mixing burners imparts a tremendous turbulence to the combustion gases, which makes possible this wide temperature range.

This furnace is available in sizes having heating spaces of 4 by 8 by 12 inches; 6 by 12 by 18 inches; and 9 by 15 by 24 inches. It is adaptable to two-valve manual control or automatic temperature control employing an air-gas proportioning valve. 74



New stops and collets brought out by Hardinge Brothers, Inc., for use on Brown & Sharpe machines

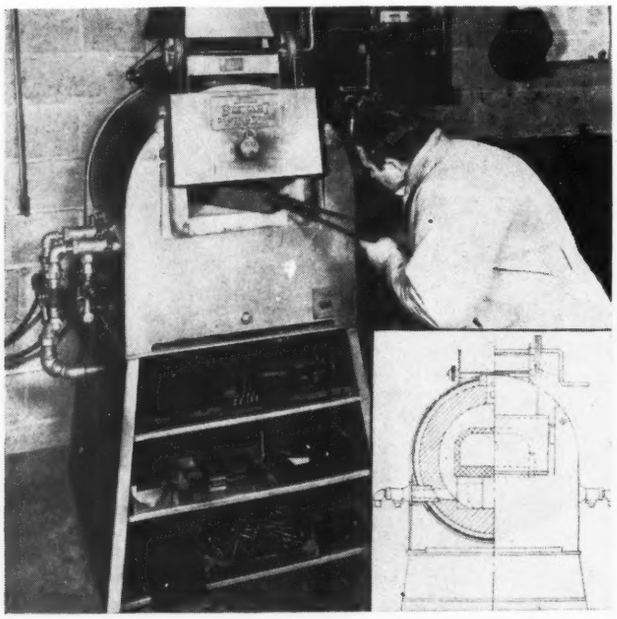
Stop Collets and Stops for Brown & Sharpe Machines

Hardinge Brothers, Inc., Elmira, N. Y., have just announced a new line of standardized stop collets and stops designed specifically for use on Brown & Sharpe machines. These collets and stops are similar in purpose to those developed for use on Hardinge high-speed precision second-operation machines.

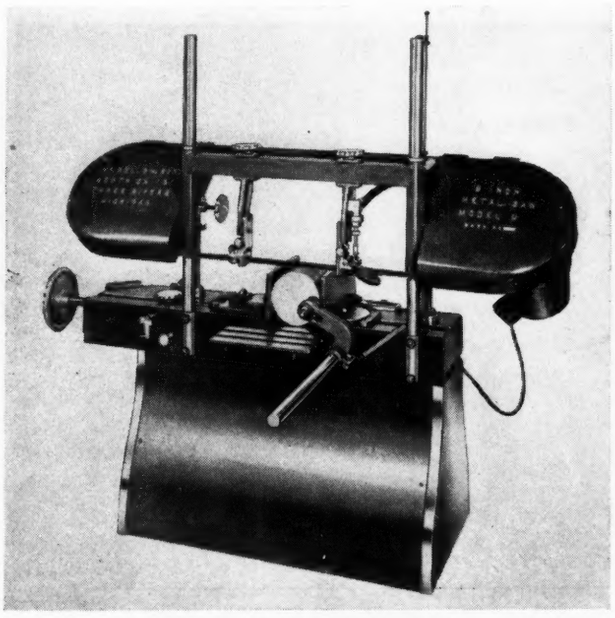
With the new collets and stops available, it is possible to start a new job in fifteen minutes instead of waiting for special equipment to be made up. The operator and set-up man can easily apply either a solid stop or a spring-ejector stop of the new line to a standard stop collet. 75

Wells Metal-Cutting Band Saw

W. F. Wells & Sons, North on U. S. 131, Three Rivers, Mich., has announced a 9-inch metal-cutting band saw. This Model M machine is designed to meet the requirements of most metal-cutting jobs. It can also be used for many jobs ordinarily performed by milling and planing, such as slotting, removing corners of die-blocks, and similar operations. Raising and lowering of the saw are effected hydraulically.

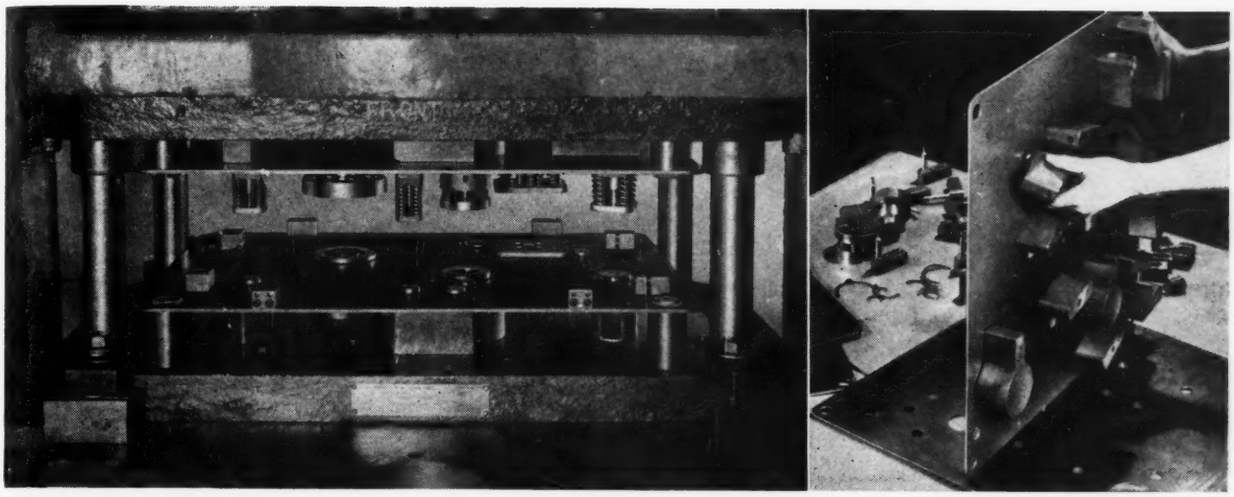


Improved design of shop or tool-room furnace



Metal-cutting band saw built by W. F. Wells & Sons

To obtain additional information on equipment described on this page, see lower part of page 228.



(Left) Die for perforating sheet-metal parts, assembled from Whistler magnetic punch and die units. (Right) Assembling Whistler magnetic die units on templet

The machine has a work capacity of 9 by 18 inches and a maximum clearance under the saw blade of 20 inches. The vise can be swiveled 45 degrees in either direction. The band saw blade is 11 feet 5 3/4 inches long by 0.032 inch thick.

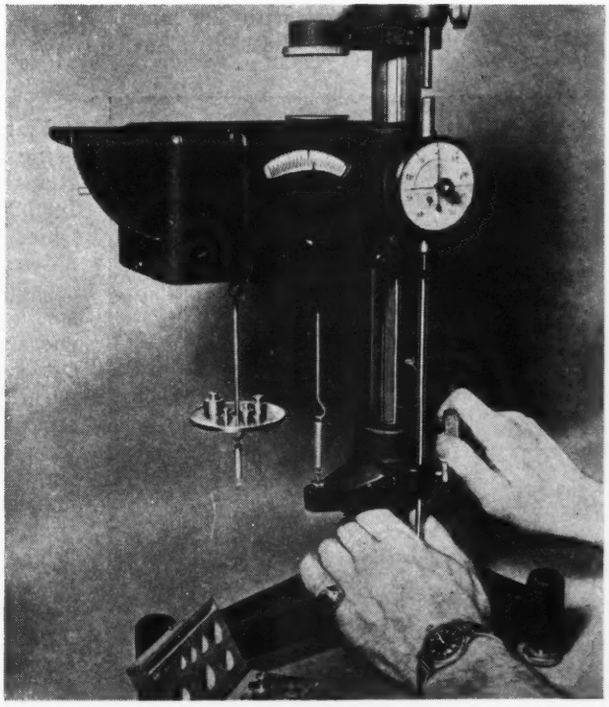
A quick-action vise clamps the work rigidly in all positions. The stock stop automatically moves outward and upward on the completion of the cut to eliminate binding of stock. A special metered valve used for displacing oil at a selected pressure on the saw blade is claimed to prolong the life of the blade. When the cut is completed, the saw will stop at a predetermined height or it can be set for a repeating cycle. A rotating brush cleans the chips from the teeth as well as from the sides of the blade. A cooling system can be supplied if desired. 76

Whistler Magnetic Perforating Dies

Magnetic perforating dies designed to provide a new faster way of making up die sets for the precision piercing of holes in various materials, including mild steel up to 1/8 inch thick, have been developed by S. B. Whistler & Sons, Inc., Buffalo, N. Y. With the new magnetic die units, a complete precision piercing die such as shown in the view at the left in the illustration can be quickly set up for efficient handling of small as well as large production jobs.

The magnetic perforating punches and dies are assembled in templet mounting plates. The view at the right shows how the die units are assembled on a templet. The same procedure is followed in assembling the punch units. On completion of any job, the punches and dies, with their retainers, are quickly removable and ready for use in a new die assembly. Only the two templets, which can be used to duplicate the original job at any time, need be placed in storage.

Punches, dies, bushings, retainers, etc., for perforating round, oval, square, or rectangular holes from 1/32 inch to 3 inches in diameter are kept in stock, and it is possible for unusual or special shapes or sizes to be quickly made to order. Tolerances can be held to 0.0005 inch. Perforating dies of any size can be assembled from the magnetic units. 77



Baldwin-Hunter spring tester

Compression and Extension Spring Tester

A tester designed for the high-production inspection and testing of any type of small compression or extension springs up to 12 inches long with loads up to 5 pounds is shown in the accompanying illustration. This tester is especially useful for inspecting springs made from wire in sizes of 0.005 to 0.030 inch in diameter. It is sensitive to load changes of less than 50 milligrams, and has a weighing accuracy within plus or minus 0.10 per cent. Arrangements for the manufacture and sale of this spring testing

To obtain additional information on equipment described on this page, see lower part of page 228.

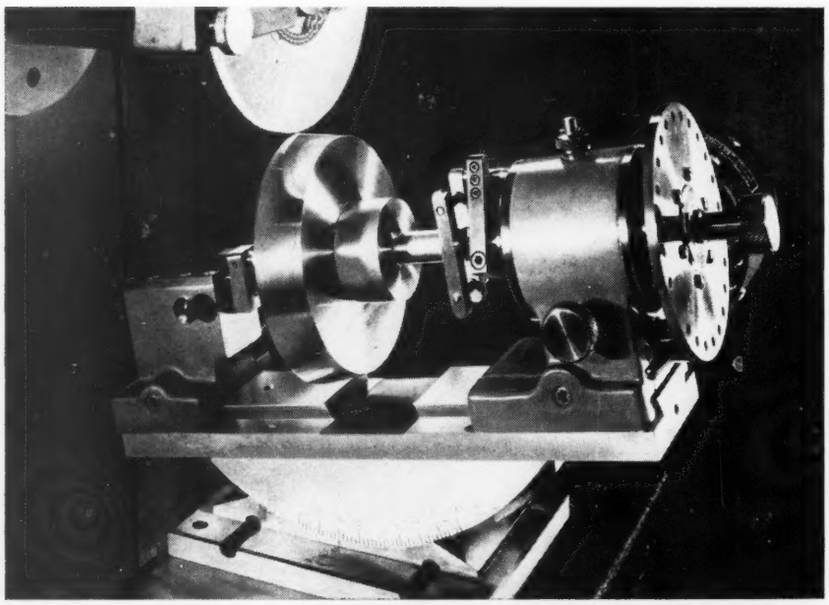
machine by the Testing Equipment Department of the Baldwin Locomotive Works, Philadelphia 42, Pa., have just been completed with the Hunter Spring Co., Lansdale, Pa. 78

"Motorized" Centers

Flat, curved, or circular work or work with straight taper and contour outlines or any combination of these forms, all held within accuracy limits of 0.0005 inch, can be set up for grinding with a new attachment developed by the Moore Special Tool Co., 734 Union Ave., Bridgeport 7, Conn. The new "motorized" centers also provide for indexing operations at the same setting. In addition to its use on surface grinders, this attachment can be used on jig borers, drill presses, light milling machines, and as an inspection tool.

The "motorized"-center attachment has a rocking bed which will swing 20 degrees either side of the horizontal position. When used with an angle-plate, the maximum taper angle becomes 30 degrees. On this bed is clamped the base-plate, which is dovetailed to permit sliding the headstocks and tailstocks into their required positions. The headstock is equipped with a live center and index-plate with twenty-four holes, jig-drilled to a tolerance of $\pm$ 0.001 inch for accurate spacing. The headstock is mounted on preloaded precision ball bearings.

The length of the device is 12 inches, and the width, including the motor, is 10 inches. The height is 8 inches, distance between centers 6 inches, and the swing, 6 inches. Equipped with a 1/25-H.P. motor, the complete unit weighs only 34 pounds. 79

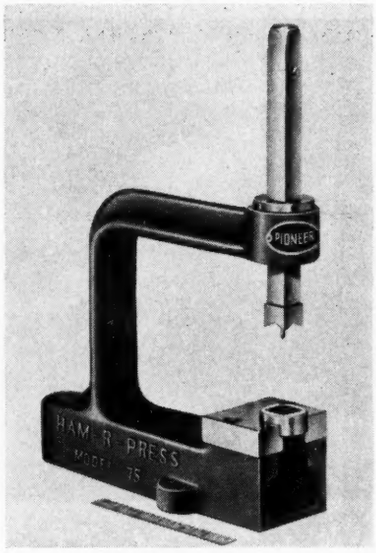


"Motorized" centers brought out by the Moore Special Tool Co.

Pioneer "Ham-R-Press"

The Pioneer Broach Co., 1424 S. Main St., Los Angeles 15, Calif., has just placed on the market a hand-operated press for use with tools of the simple punch and die type. Although this machine, called the Pioneer "Ham-R-Press," was designed to meet the needs of electronic technicians and radio manufacturers, it is being used in the mechanical fields as well. Outstanding basic features include simple operation and set-up; precision alignment of ram and work-table; variable pressures ranging from a few pounds to several tons; deep throat capacity; and low cost.

The operating principle consists of the transmission of hammer-blow pressure through the vertical ram directly to the working point, pressure on the arms and back of the frame being eliminated. In operation, the punch is simply slipped on a tongue at the bottom of the ram and the die is placed in the opening on the work-table and locked by a set-screw. The material to be worked is placed over the die and the ram is lowered into contact with the material. The top of the ram is then struck a blow with a hammer. The punching power is optional, but impact pressures as high as 15 tons are easily obtainable.



"Ham-R-Press" brought out by the Pioneer Broach Co.

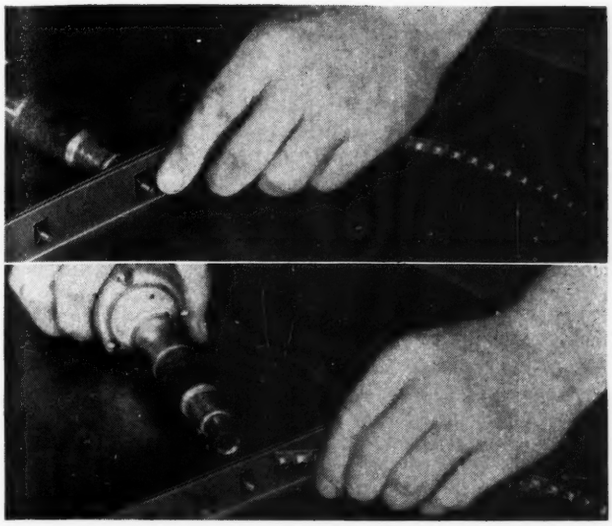
The "Ham-R-Press" is available in four models having throat depths of 5, 7 1/2, 12, and 24 inches. A complete line of punches, dies, and attachments is available, including punches for round holes ranging in size from 1/8 to 1 1/2 inches in diameter, and for square and oval holes from 3/8 to 7/8 inch. Combination cuts can be made with these punches to obtain any shape of hole desired. 80

Tandem Type "Speed Nuts"

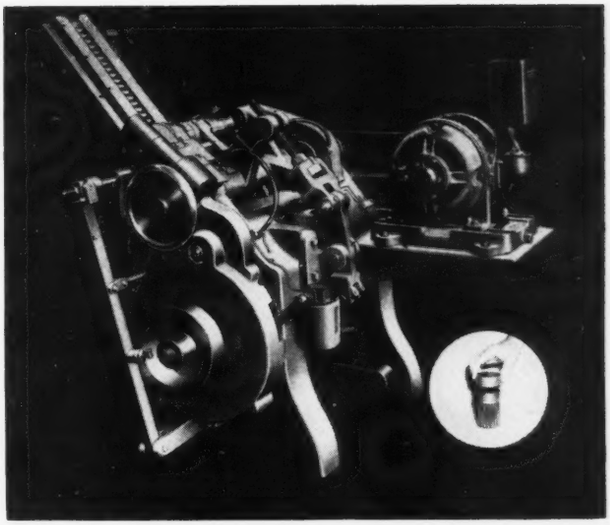
Flat type "Speed Nuts" are now being produced in continuous strips by Tinnerman Products, Inc., 2035 Fulton Road, Cleveland, Ohio. The new product, designated the "Tandem Speed Nut," consists of a strip of pretempered spring steel into which the fasteners are stamped, a partial shear cut separating each unit. This permits the operator to break the strip from the leading Speed Nut with a clean separation as it is tightened, making possible a tremendous saving in assembling time.

The leading Speed Nut is always at the tip of the screwdriver, eliminating lost motion in selecting a fastener, picking it up, and carrying it to the work. Location of the nut and starting of the screw are also facilitated, since

To obtain additional information on equipment described on this page, see lower part of page 228.



Illustrations showing method of using Tandem Type "Speed Nuts"



Threading and trimming machine brought out by the V & O Press Co.

the longer strip can be handled more easily than an individual nut. These nuts are available for 10-24 screws, and are produced in either strips or coils. 81

Curtis Suspended Type Abrasive-Belt Polishing and Grinding Machine

The Curtis Machine Corporation, 1300 E. 2nd St., Jamestown, N. Y., is producing an abrasive-belt polishing and grinding machine designed for many varied applications in the metal-working field. This machine consists of two parts—an abrasive belt unit and a table unit. It can be had with or without the table unit.

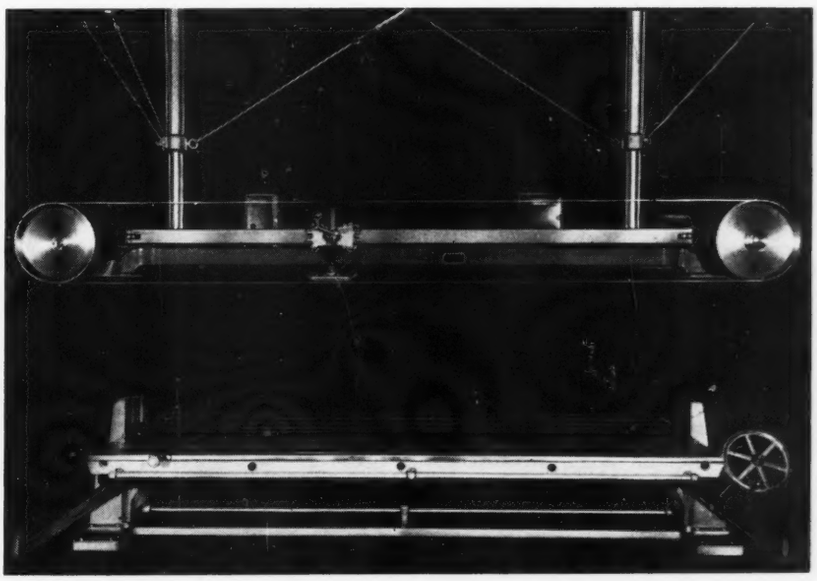
The abrasive-belt unit is suspended from the ceiling, and is adjustable vertically by a motorized unit on two telescoping tubes. This arrangement permits the machine to be raised or lowered to suit work of varying height. Downward adjustment to the working position can be accomplished quickly by means of a push-button control. These units can be suspended directly over an assembly line for grinding or polishing large surfaces on finished metal cases or cabinets or they can be used in connection with the table unit for polishing or grinding flat sheets.

This equipment is particularly adapted for use in metal-working shops where many different forms and shapes of work are handled. It is available in 6-, 8-, or 10-foot lengths and in single- or double-belt style. The double-belt machine permits the use of a coarse abrasive for stock removal and a finer abrasive for finish polishing. The traveling head enables large areas to be sanded rapidly with minimum operator fatigue. 82

V & O Threading and Trimming Machine

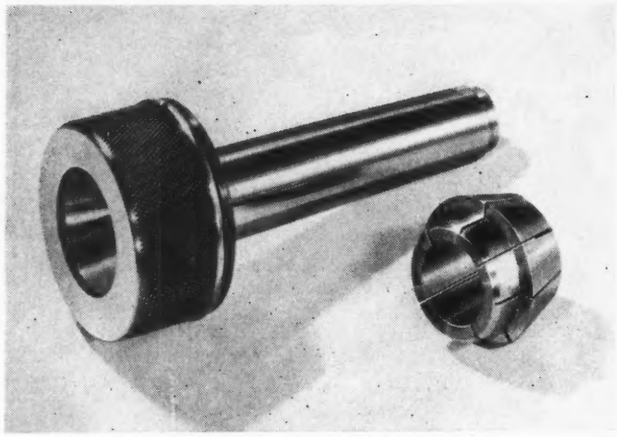
The V & O Press Co. Division of Rockwell Mfg. Co., Hudson, N. Y., has placed on the market a No. 302 machine which, in addition to threading and trimming, can also be utilized for beading, knurling, and curling. These operations can be performed separately or in combination, depending upon the nature of the work. The machine shown in the accompanying illustration is provided with a chute into which the parts are placed by the operator. From the chute, the parts (in this case cans) are fed automatically to the chuck, threaded, and automatically ejected at the rate of 35 pieces per minute. By interchanging the chucks, the covers for the cans can also be handled with the same sequence of operations.

The machine is adapted for performing operations on flashlights, film cans, bottle caps, and similar products made from steel up to 3/32 inch thick. It is 4 1/2 feet high, 5 1/2 feet front to back, and 6 1/2 feet wide. The machine is driven by a 2-H.P., 900-R.P.M. motor using a V-belt drive. 83

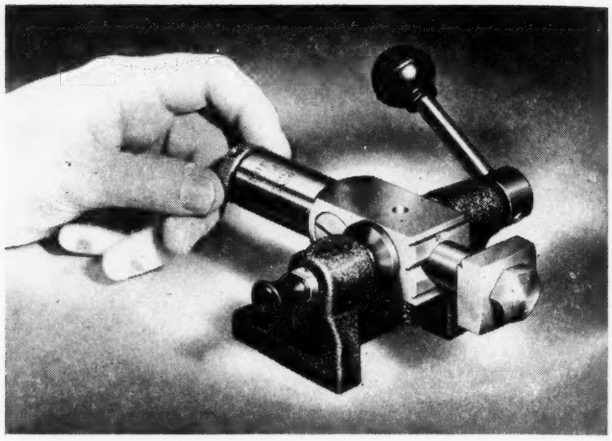


Curtis suspended type abrasive-belt polishing and grinding machine

To obtain additional information on equipment described on this page, see lower part of page 228.



South Bend centerless-shaft supporting chuck



"Mikro-Vise" designed for holding small parts

Centerless-Shaft Support Chuck for Lathes

To meet the need for a simple and practical device for supporting centerless shafts concentrically in lathes, the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind., has brought out an adjustable collet bushing chuck of the design shown in the illustration. This new device, on which a patent is pending, makes possible easy and accurate centering in the lathe of any shaft 1/4 to 1 inch in diameter. It is made with No. 2 or No. 3 Morse taper shanks for use in either the headstock or tailstock spindle.

Brass collets can be supplied for round stock in sizes from 1/4 to 1 inch. A special size collet for 0.637-inch round shafts is available for chucking automobile generator armatures having centerless shafts of this size.

When used in the lathe headstock, the collet bushing can be adjusted to drive the work or, when used in the lathe tailstock, it can be adjusted for an accurate running fit. 84

Hancock Automatic Power Benders

A line of power benders designed to form intricate bends in metal moldings, tubes, and frames is being manufactured by the Hancock Tool & Die Corporation, 17005 Fullerton Ave., Detroit 27, Mich. High torque output, all-electric controls, and both manual and automatic cycle operation are features of these new machines. They can be easily arranged to meet individual requirements as to operating speed, torque capacity, and size of work.

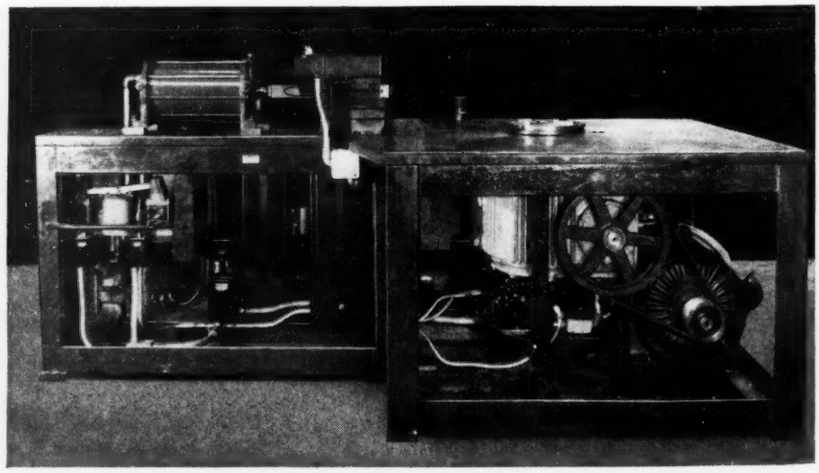
Basic operating components include a rotary fixture drive and a pressure cylinder arrangement by which the work is bent to the shape of the fixture as the latter member revolves. The rotating fixture table is so designed that a wide variety of fixtures can be readily interchanged. The machine shown in the illustration has a torque capacity of 44,000 inch-pounds, and employs a 15-H.P., 1200-R.P.M. motor.

These machines can be operated automatically in either a forward or a reverse direction. The operator merely clamps one end of a piece of rolled stock or tubing in the fixture and presses the starting button. As the fixture revolves, a shoe is forced against the stock by an air cylinder, forming the strip or tubing to the external contour of the fixture. The machine stops automatically at the end of the operation. 85

"Mikro-Vise" and Fixture Designed for Holding Small Parts

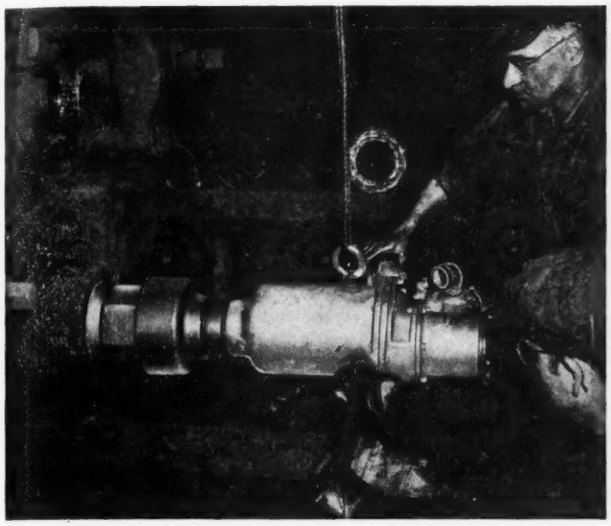
A precision device, designated "Mikro-Vise," for holding small parts has been introduced by Metal Items, 820 Sixth St., Racine, Wis. It consists of two units —a vise and a fixture—both designed for rigidity and versatile positioning and holding of small parts. Each side of the vise unit can be used for clamping or holding work with the hardened jaws.

The clamping jaws are provided with two sizes of V-shaped slots for holding round pieces of various diameters. Provision is made for inserting pins for holding odd-shaped parts. The jaws are 1 1/8 inches wide and open to 1 1/4 inches. The fixture has an adjustable locking lever and is designed to facilitate angular, horizontal, and vertical positioning of a wide variety of work. 86

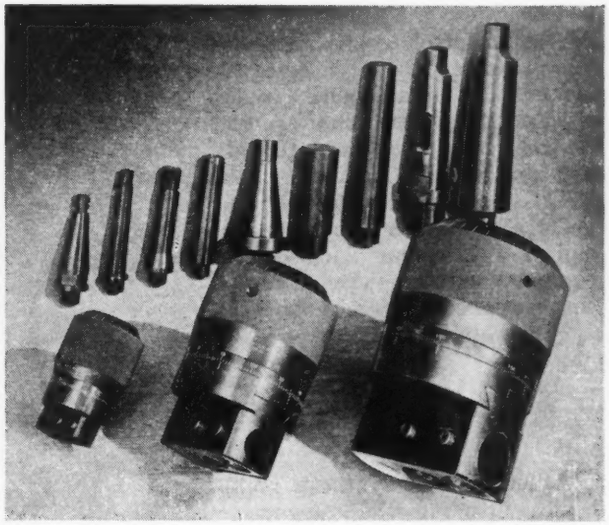


Hancock power bender equipped for forming automobile window moldings at the rate of 180 pieces an hour

To obtain additional information on equipment described on this page, see lower part of page 228.



Ingersoll-Rand impact tool for setting up extremely large bolts and nuts



Quick reversing boring-facing tools brought out by the Maxwell Co.

Giant Size Air Impact Tool for Setting Up Heavy Bolts

A giant size air-operated impact tool, known as the "Slugger," has been added to the line of bolt and nut tightening or setting tools made by the Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. This tool has been designed for extremely heavy bolting-up jobs such as were formerly handled, with considerable danger to the worker, by sledging or battering box type wrenches.

The new impact tool is the largest of its type manufactured, and has a capacity for setting bolts up to the 4-inch size. It is capable of handling both maintenance and production work, and has been especially designed for the rapid repair of heavy equipment and to save time in the manufacture of all types of machinery involving the use of large studs, bolts, and nuts.

The tool weighs 215 pounds, has a free speed of 355 R.P.M., with 550 impacts per minute, and operates with a 2 1/2-inch square driver. The over-all length to the shoulder of the anvil is 26 5/8 inches, and the side-to-center distance of the hammer case is 4 inches. 87

Improved Boring-Facing Tools

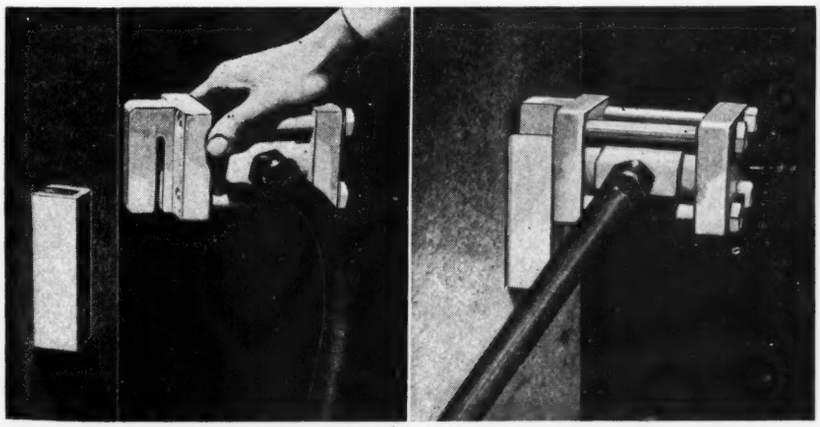
The Maxwell Co., 420 Broadway, Bedford, Ohio, announces that it has modified its "E-Z-Set" boring-facing tools to include a new quick reversing feature which adapts them for use on a wide variety of production machines for single-point facing operations, especially on machines not equipped with reversing spindles. The new feature permits quick reversing of the tool-block after it has been fed out to the maximum facing diameter and stopped. Facing operations are accomplished in the usual manner by holding the knurled collar on the tool while the spindle is rotating.

The quick reversing feature is available on the Model 41 "E-Z-Set" having a maximum capacity of 15 inches, and on the Model 42, which has a maximum capacity of 20 inches. In addition to a boring-bar for both maximum and minimum diameters, a stub boring-bar for facing operations and a complete line of interchangeable shanks have been added to this improved line of tools. 88

Pneumatic Vibrator Designed for Quick Attachment and Removal

The Cleveland Vibrator Co., 2828 Clinton Ave., West, Cleveland 13, Ohio, has brought out a powerful pneumatic vibrator that can be quickly attached to and removed from units that require vibration, such as concrete forms, mold boxes, hoppers, screens, foundry flasks, fatigue-testing equipment, etc., where the vibrator installation cannot be permanent. The vibrating mechanism is designed to withstand continuous use. It is equiped with a milled steel hook. Brackets designed to receive and securely hold the vibrator hook are obtainable for welding or bolting to the member that is to be vibrated.

The vibrator unit is obtainable in a 2-inch piston diameter size,



Cleveland pneumatic vibrator designed to be quickly attached to and removed from part to be vibrated

To obtain additional information on equipment described on this page, see lower part of page 228.

and operates on 50 to 100 pounds per square inch continuous air-line pressure. The number of vibrations per minute and the intensity of the vibrations can be controlled by regulating the air pressure.

The unit weighs 14 pounds, and is 6 3/4 inches long, 4 inches high, and 3 1/2 inches wide. It is equipped with a swivel-hose fitting designed to receive hose of 1/2 inch inside diameter. 89

Simonds "Fibrex Red Wheels"

A new type of synthetic resin-bonded grinding wheels known as "Fibrex Red Wheels," has been brought out by the Simonds Abrasive Co., Tacony and Fraley Sts., Philadelphia 37, Pa. These wheels are manufactured from laminated sheets of cotton fiber filled with

"Fibrex Red Wheels" made by Simonds Abrasive Co.

abrasive grain. Their field of application is between that of heavy grinding and light sanding, as well as for certain types of abrasive cutting off, deburring, and finishing operations.

The new wheels are made in two types — depressed-center wheels for use on portable machines and straight wheels for cutting off and general-purpose use. The depressed-center wheels are available in 7- and 9-inch sizes, and the straight wheels in diameters of 6, 8, 10, and 12 inches with 1/8 inch thickness.

These wheels are slightly flexible and allow a certain amount of side pressure. They are especially adapted for weld grinding, particularly on stainless steel, and for cleaning up rough surfaces on structural steel work, fabricated metal parts, etc., as well as for grinding a wide variety of non-metallic materials. 90

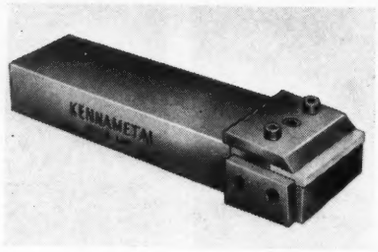


Fig. 1. Kennametal new roll-turning tool

Fig. 2. Round-nose tool for large-hole boring

Kennametal Turning and Boring Tools

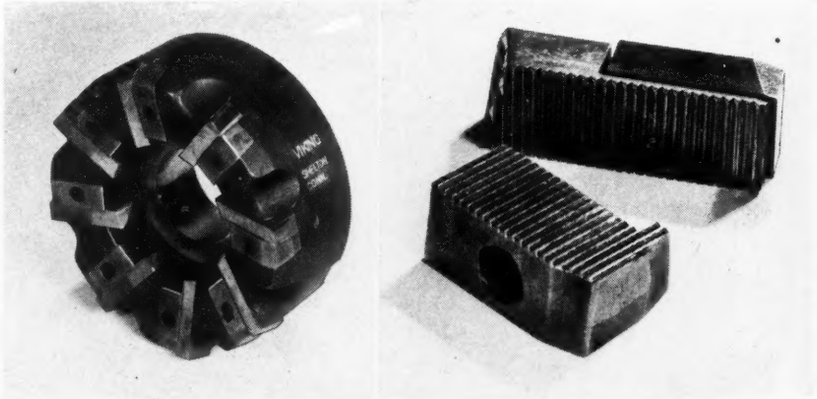
Kennametal, Inc., Latrobe, Pa., has introduced a new mechanically held roll-turning tool for longitudinal-feed lathes. This Style LRT tool has a square nose, as shown in Fig. 1, and is designed to be set at an angle in the tool-post to allow for the desired depth of cut. The solid Kennametal blade is held in position on an accurate surface of the supporting shank by a clamp and an adjustable back-up plate, each of heat-treated steel. The blade has four cutting edges that can be used in succession before any resharpening is necessary. It can be reground many times on the long sides. The tool is made in two sizes—2 1/2 inches wide by 1 7/8 inches high by 15 inches long; and 2 1/2 inches square by 15 inches long.

The round-nose Style 16T tool shown in Fig. 2 is another recently developed Kennametal product designed for boring operations performed by taking a plunging cut and feeding in both directions. This tool is also available in two sizes—1 inch wide by 1 1/4 inches high by 12 inches long; and 1 inch wide by 1 1/2 inches high by 12 inches long. The brazed-on Kennametal tip of each size has a 1/4-inch radius at the extreme point which blends into 1/2-inch radii at the sides. 91

Viking Carbide Face Milling Cutter

The Viking Tool Co., P.O. Box 286, Nichols Road, Shelton, Conn., has developed a new carbide face milling cutter combining the stock removal qualities of brazed-on and serrated-blade tipped cutters with the economical regrinding features of the solid carbide-bladed face mills. The main feature of the new face mill is a large carbide tip with just sufficient steel backing to effect the addition of serrations to the back of the blade. This construction is said to eliminate the tendency toward cracking of carbide under thermal strains.

Positive locking of the blade in the cutter body is effected by a hardened tool-steel serrated wedge located behind the blade. The wedge has a lip on its outer portion which provides a positive resistance to the feeding thrust on the blade, independently of the locking screw. The locking screw

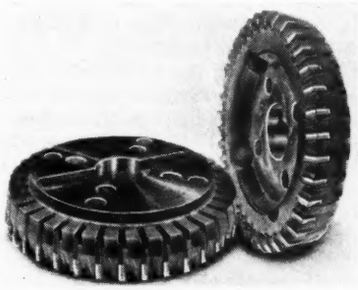


(Left) Carbide face milling cutter made by Viking Tool Co. (Right) Large carbide tips with serrated steel backing used in milling cutter shown at left

To obtain additional information on equipment described on this page, see lower part of page 228.

is the same as that used in the Viking single-point carbide-tool holders, providing positive withdrawal of the wedge, as well as the locking action.

Up to 90 per cent of the carbide in this tool can be consumed before blade replacement is necessary. These face mills can be supplied with the number of blades required and with the radial and axial rake angles needed to suit the specific job, including double negative, zero, and double positive rake angles. Other combinations of rake angles and numbers of blades per cutter can be manufactured to order. 92



"Shear Clear" face milling cutter with carbide-tipped blades

Ingersoll Face Milling Cutter

The Ingersoll Milling Machine Co., Rockford, Ill., has developed and patented a "Shear Clear" face milling cutter with carbide-tipped blades, designed for milling cast iron at high feed rates. The new cutter embodies the fundamental "Shear Clear" principle of cutting on the bevel portion of the blades, which are set into the housing at negative radial and positive axial rake angles. It has very fine blade spacing—thirty-eight blades in a 10-inch cutter—and uses new cutting angles that are the result of extensive research and tests.

A 10-inch "Shear Clear" cutter recently milled the top surface of 5625 automotive cylinder blocks on an Ingersoll milling machine before becoming dull. The average life of cutters previously used for this work was 1500 to 1800 blocks per grind. 93

Jacobs Lathe Chuck with Rubber-Flex Collet

A lathe collet chuck of radically new design, as shown by the cutaway view in Fig. 1, has just been

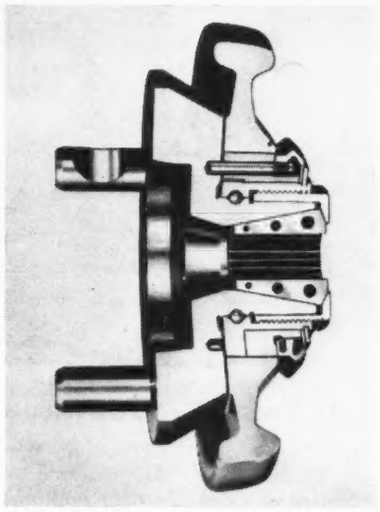


Fig. 1. Cut-away view of Jacobs spindle-nose lathe collet chuck

announced by the Jacobs Mfg. Co., West Hartford 10, Conn. This chuck is said to be exceptionally accurate, the run-out at the nose and at points several inches from the nose being held to extremely close tolerances. It is also claimed that this chuck has unusual gripping power, a feature that enables the operator to use the highest speeds and feeds available in modern tool-room lathes without danger of slippage or scoring of the work.

The exceptional accuracy and gripping power of this chuck are attributed in a large measure to the newly developed Rubber-Flex collet, composed of special "Hycar" synthetic rubber, bonded and mechanically locked to hardened and ground tool-steel jaws, as shown in Fig. 2. Each collet has a full 1/8-inch gripping range, which is equivalent to the work-holding range of eight split steel collets. Only eleven "Rubber-Flex" collets are needed to chuck any bar between 1/16 inch and 1 3/8 inches in diameter.

An important feature of the chuck is the ease with which it permits work to be gripped or released. A special impact mechanism locks the work in place, or

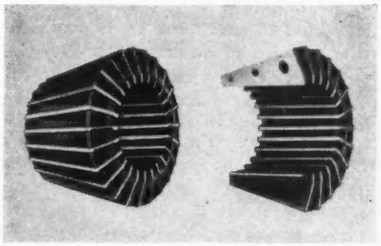
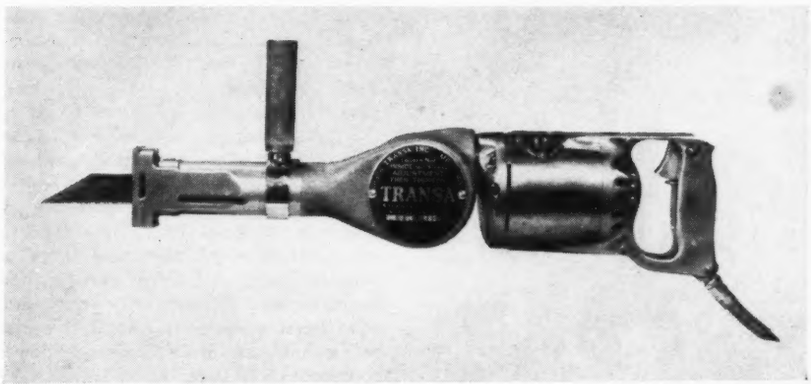


Fig. 2. Cut-away view of Jacobs "Rubber-Flex" collet shows how rubber is permanently bonded and mechanically locked to the jaws

frees it, with a few sharp impacts administered by quickly rotating the large aluminum handwheel. Models are now available for camlock, taper-key drive, American Standard, and threaded types of machine spindles. 94

Transa Gun Type Saw

Portable gun type electric saw for cutting any material, from wood to steel, recently introduced by Transa, Inc., Department MH, Suite 440-445, Gateway Bank Bldg., Minneapolis, Minn. Adapted for performing a wide variety of sawing operations in foundries, factories, sheet-metal fabricating plants, air-conditioning and heating installations, and for general maintenance in plants of all kinds. The stroke is adjustable up to 2 inches. Special guides are available for blade widths ranging from 1/2 to 1 inch. 95



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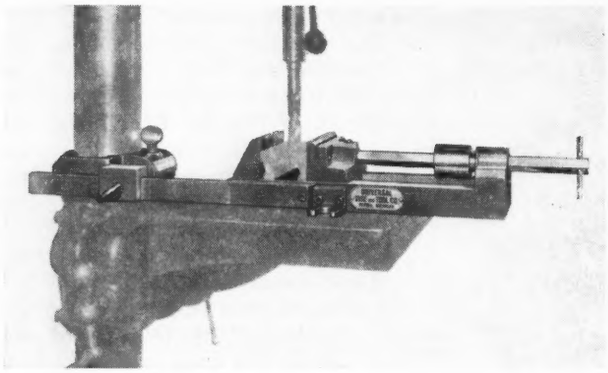
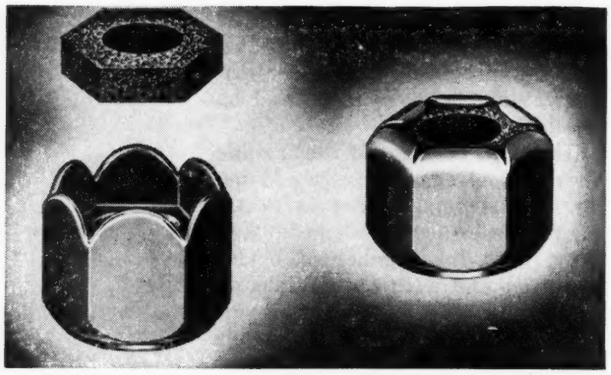


Universal "Col-Vise" for Drill Press

"Col-Vise" developed by Universal Vise & Tool Co., Parma, Mich., which can be clamped to the column of single- or multiple-spindle drill presses for holding a variety of work. Designed to save time on typical drill press operations. Position of vise is adjustable both angularly and radially, and entire device can be swung clear of working position. Jaws are 1 1/2 by 4 inches and have a maximum opening of 6 inches. Made in models to fit drill presses with either stationary or movable tables and with columns of various sizes ranging from 1 7/16 up to and including 3 29/32 inches in diameter. 96

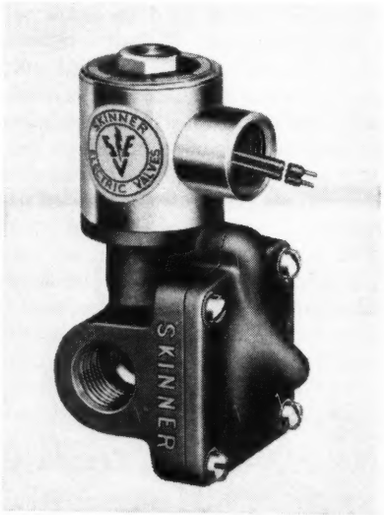


Townsend "Tufflok" Self-Locking Nut

Self-locking hexagonal nut with an improved locking insert designed to prevent rotation within the nut and to maintain a tight grip on the bolt. The insert is chemically treated to resist both absorption of moisture and drying out, which might cause the locking grip to loosen. The cold-forged nut body, in combination with the tough insert, provides strength and durable qualities that fully meet the Army-Navy requirements for aircraft work. Available in sizes ranging from 4 through 3/8 inch. Produced and sold by the Townsend Co., New Brighton, Pa., under patents of the Nylok Corporation, New York, N. Y. 97

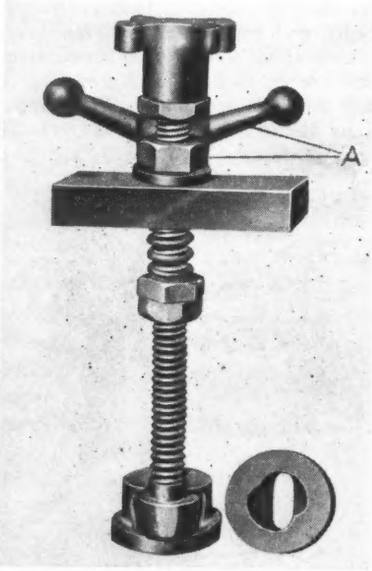
Morton Fixture Clamp

Fixture clamp of unique design developed by the Morton Machine Works, 2421 Wolcott St., Detroit 20, Mich., for clamping castings by passing the T-bolt of the clamp through a bored hole in the work. The alloy steel T-bolt engages a hardened insert which is ground for a press fit in the bottom of the pilot plate. T-bolt can be cut off to provide most convenient operating height. The spherical collar nut and the steel ball handle indicated by leaders (A) are optional clamp tightening equipment, either one being used as required. Lock-nuts and spring can be adjusted for height and to prevent clamp strap from dropping to bottom of T-bolt. 98



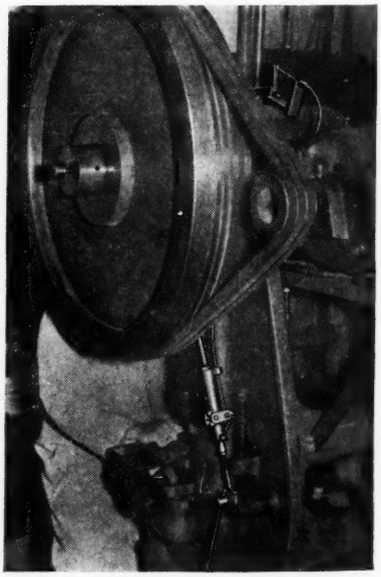
Safety Device for Power Presses

Power press equipped with non-repeat safety device brought out by Searjeant Metal Products, Inc., Department 9-7, Box 101, Mendon, N. Y. This safety device is designed for easy installation on small bench presses or large floor presses. It acts as a secondary clutch, the downward action of the press ram serving to release this clutch and allow the upper portion of the treadle-rod to disengage the primary clutch on the press flywheel. Should the operator continue to hold the treadle down, the press will not repeat until the treadle has been brought back to the upper position. This action will re-engage the clutch in the non-repeat device. 100



Skinner Solenoid Valve

One of a new line of three-way bronze-body solenoid valves announced by Skinner Electric Valve Division of Skinner Chuck Co., Norwalk, Conn. Designed for such applications as industrial machinery, chemical process equipment, air vises, air and hydraulic cylinders, etc., and for use with petroleum, gasoline, water, air, and inert gases at operating pressures from 20 to 150 pounds per square inch. Normally open, normally closed, and directional flow control types are available with 3/8-inch orifice and 3/8- or 1/2-inch National Pipe Thread ports. All internal metal parts are brass or stainless steel. All valves can be used for continuous or intermittent duty, and have been operated up to 300 cycles per minute on air. Maximum power consumption is 10 watts. 99



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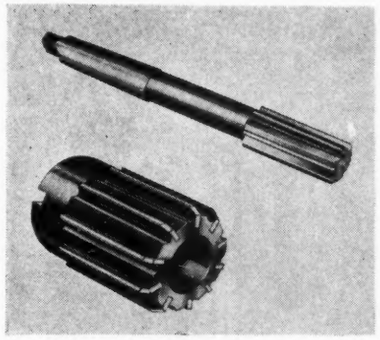
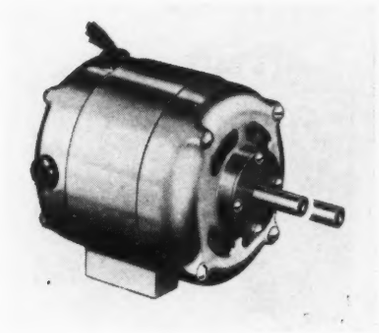


Hasley High-Speed Reamers

High-speed reamers with cutter blades of high-speed steel firmly secured in recesses of a low carbon steel body by means of a rolling process (Palm Patent). The rolling process involves no application of heat that might affect the temper, hardness, and durability of the cutter blades. Rerolling and sharpening at the factory will restore worn and under-sized reamers of this type to new sharpness and their original diameter. Standard sizes are available up to 6 inches in diameter; special and step reamers can be built to specifications. Announced by Hasley Products Co., 29706 Grand River Ave., Farmington, Mich. 101

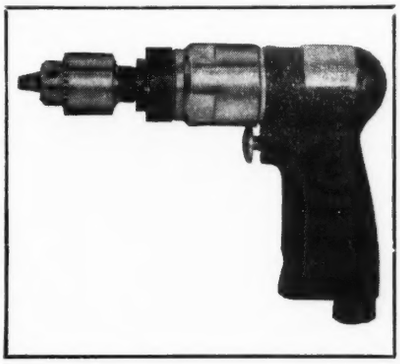
"Electrodip" Heating and Melting Pot

Dip tank or melting pot known as the "Electrodip," announced by the H. McNaughton Co., 201 Parsons St., Kalamazoo, Mich. This insulated thermostatically controlled tank is adapted for applying removable plastic coatings on parts or tools by dipping. It can also be used with an oil bath to transfer heat at accurately controlled temperatures to irregular-shaped devices and to heat or melt without charring viscous compounds, waxes, greases, and similar material. Thermostat range is 60 to 250 degrees F. or 200 to 500 degrees F. Over-all size, 12 by 12 by 10 inches, with thick walled dip compartment 6 inches deep, 7 by 7 inches at top, and 5 by 5 inches at bottom.....103



Electric Motor Corporation's New Motor

New Model 700 motor manufactured by the Electric Motor Corporation, Division of Howard Industries, Inc., Racine, Wis. This motor can be series-wound to meet the exact power requirements of any product within the range of 1/15 up to 1/2 H.P. continuous duty or up to 3/4 H.P. intermittent use. When shunt-wound, it has an intermittent-duty rating of 1/2 H.P. It can be wound for voltages ranging from 6 to 230 direct current or alternating-direct-current. Its housing can be ventilated or totally enclosed. Rotation is clockwise, counter-clockwise, or reversible, as required. An internal fan is included for cooling the motor which has a top idling speed of 20,000 R.P.M. 104

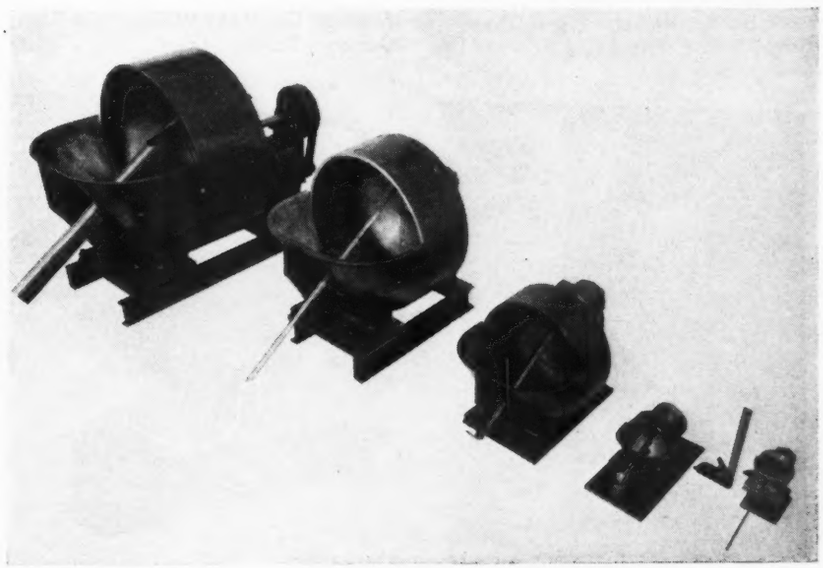


Midget Size Pneumatic "Master Power" Rotary Tool

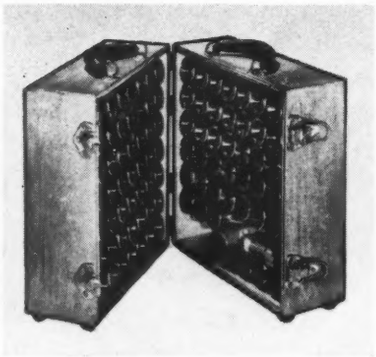
Midget size, 1/4-inch capacity, rotary drill called the "Master Power" M-900, available in free speeds of 1200, 2400, and 4800 R.P.M., for drilling up to 1/4-inch holes in all kinds of materials and metals. Weighs 2 pounds, and is only 6 3/8 inches long. Features of this tool include powerful internal blade type vibrationless motor; pistol-grip handle and motor housing of special alloy heat-treated aluminum; large oil reservoir inside handle which provides constant lubrication through automatic oiler while drill is in operation; and button type throttle which permits accurate control of drill bit. Placed on the market by the Master Pneumatic Tool Co., Inc., Orwell, Ohio. 102

Kraus Work-Feeding Hoppers

Five different sizes of a new type of work-feeding hopper developed by Kraus Design, Inc., 41 S. Water St., Rochester, N. Y. These hoppers range in size from the 4-inch model shown at the right to the 32-inch model shown at the extreme left. Each hopper was designed for a specific purpose. The 4-inch size, for example, was developed to handle screws 0.227 inch long with a diameter of 0.045 inch, and is used in conjunction with a hopper designed to handle washers 0.100 inch in diameter and 0.025 inch thick with a 15-degree bevel. These hoppers feed the parts into nests of a special assembly machine where the washer is placed on the screw right side up. The two pieces thus assembled are then ejected automatically. 105



To obtain additional information on equipment described on this page, see lower part of page 228.

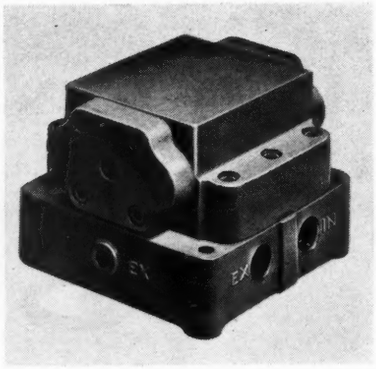


Zagar Collets with Carrying Case

Carrying case with complete set of 5-C collets consisting of 67 round collets ranging from 1/16 inch to 1 3/32 inches in diameter; 9 square collets from 1/4 to 3/4 inch; and 11 hexagonal collets from 1/4 to 7/8 inch, all varying in size by steps of 1/16 inch. The pegs for holding the collets are clearly marked with the sizes. Space is provided in the case for additional collets, wrenches, or attachments. The case is 12 by 12 by 8 inches in size. Announced by Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 23, Ohio. 106

Westinghouse Mot-O-Trol Adjustable-Speed Drive

Adjustable-speed drive known as "Mot-O-Trol," employing electronic precision equipment designed to provide a wide stepless range of speed control for fractional-horsepower direct-current motors operated from alternating-current lines. This drive will start motors, bring them up to a preset speed smoothly and rapidly, permit change of speed at any time, and apply dynamic braking for stopping and reversing. The sub-assembly construction of the unit permits complete sub-assemblies to be removed to facilitate maintenance. A single dial provides finger-tip control of the motor. Made by Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. ..107

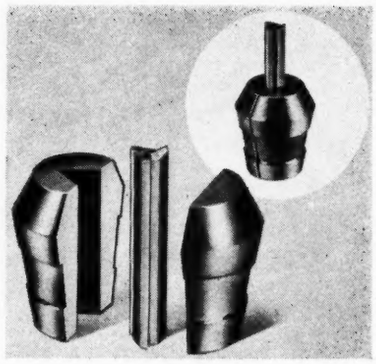


Hanna "Mastair" Valve

New four-way "Mastair" valve of the balance spool type controlled by one four-way or two three-way pilot valves. Pipe can be connected to either the bottom or sides of this valve, and the parts can be removed without disconnecting the pipe. Spool and sleeve assembly can be easily taken out by removing end caps. Parts are interchangeable in any size. Made in capacities of 3/8, 1/2, 3/4, and 1 inch. Control pilot valves are available in cam-, lever-, push-button-, and foot-operated types. Announced by Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. 108

Adjustable Tool-Holder

Lathe tool-holder with true vertical adjustment for turning, facing, threading, boring, and cutting-off operations. Consists of a shank for standard toolposts and three heads for mounting tool bits, cut-off tools, and boring-bars. Shanks and heads are so made that the cutting edge can be positioned exactly on center and yet will retain a perfectly horizontal position. Available in three sizes with shanks 5/8 by 3/8 inch, 1 by 1/2 inch, and 5/8 by 1 3/8 inch to take tool bits from 1/4 inch to 1/2 inch square. Announced by Brand Tool & Supply Co., 2411 W. Magnolia Blvd., Burbank, Calif. 109

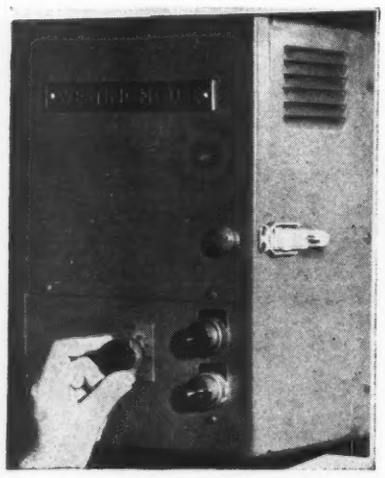


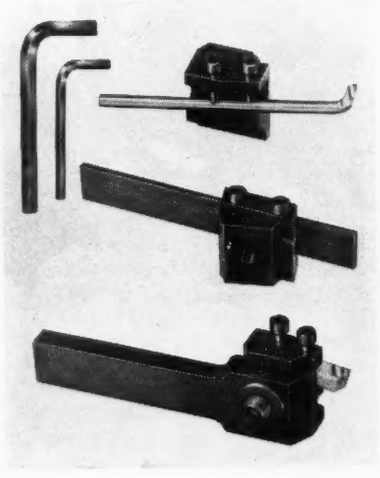
Kennametal "Triple-Life" Router Bit

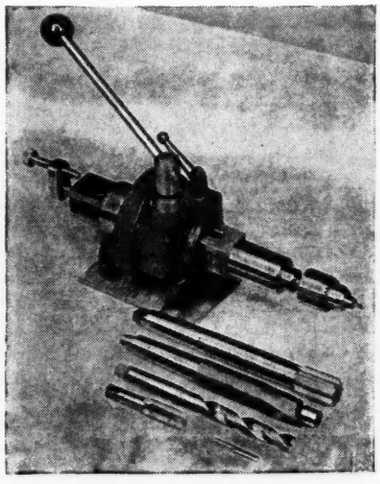
"Triple-Life" router bit made of solid Kennametal, designed for routing soft and hard woods, plywood, fiber board, and plastics, as well as type metal. The bit has three cutting edges, but it is so clamped in the routing machine chuck by collet pads that only one edge is operative at a time. When this edge becomes dull, the bit is turned to bring another edge into the cutting position. The dull edges can be easily sharpened with diamond dust by employing a suitable size drill rod mounted in a drill press or lapping machine. The router bit is made in five sizes with cutting diameters of 1/4, 5/16, 3/8, 7/16 and 1/2 inch. Developed by Kennametal, Inc., Latrobe, Pa. 110

Star Sensitive Turret Attachment

Sensitive turret attachment designed for handling delicate work on a turret lathe. Can be used for tapping threads in sizes from 6-32 to 4 inches, and for operations such as centering, drilling, reaming, and counterboring. The attachment can be mounted in any one of the turret positions, so that the handwheel can be used to bring the turret up close to the work. Lever arm for actuating in and out motion provides sensitive control over the machining operation. Made in five sizes, all





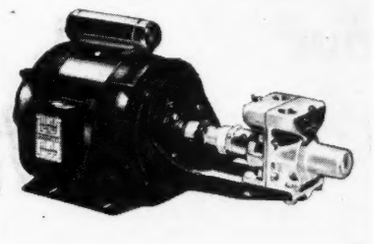


To obtain additional information on equipment described on this page, see lower part of page 228.

of which can be mounted directly on turrets with or without adapters, depending upon make and model of lathe used. Announced by Williams & Hussey Machine Co., Inc., Wilton, N. H. 111

Eco Electric Motor-Driven Pump Unit

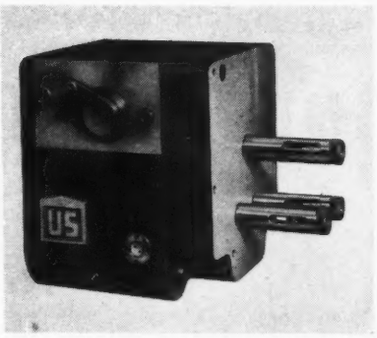
General utility close-coupled electric motor-driven gearless pump unit designed to simplify installation. Made in multi-purpose models with 1/4-,



3/8-, 1/2-, and 3/4-inch ports. The pumps are designed to give efficient suction lift service ranging from simple circulation work up to heavy-duty operation against pressures of 150 pounds per square inch. Supplied in 1/4-, 1/3-, and 1/2-H.P. models. Announced by Eco Engineering Co., 12 New York Ave., Newark 1, N. J. 112

Sight Glass for Viewing Flow of Liquid in Pipe Lines

Sight glass designed to permit observing the clarity or turbidity of transparent liquids flowing under pressure through pipe lines. Differential pressure is established across the deflector to allow some of the liquid to circulate continuously through the glass observation bowl. The observation bowl can be removed for cleaning. Developed by Worthington Pump & Machinery Corporation, Harrison, N. J. 113

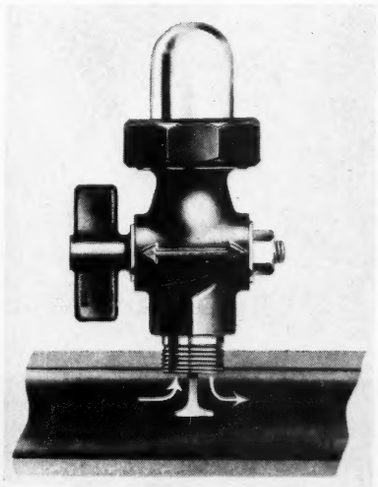


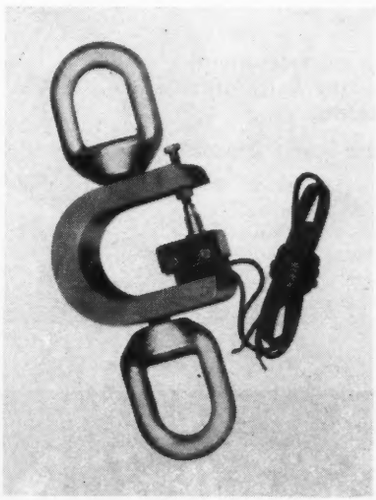
Multiple-Speed, Fixed-Center Drill Head

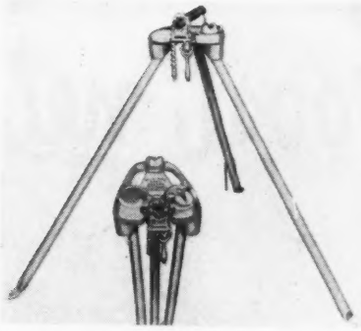
Multiple-speed, multiple-spindle drill head built by the United States Drill Head Co., Cincinnati 4, Ohio, to provide the correct peripheral speeds for drilling, tapping, and reaming different materials on machines having a single-speed drive. The head is oil lubricated, and designed for operation at speeds up to a maximum of 15,000 R.P.M., but speeds on individual spindles can be changed as required to suit specific operations, such as tapping and facing. 114

Dillon Overload Protection Device for Cranes and Hoists

Improved "Dyna-Switch" designed to protect hoists or cranes from accidental overloads and prevent injury to workers. Developed by W. C. Dillon & Co., Inc., 5410 W. Harrison St., Chicago 44, Ill. The device slips on the hoist or crane hook and the load is lifted directly beneath it in the usual manner. If safe capacity of the hoist is exceeded, the circuit automatically opens, cutting out motor and preventing operator from making the lift. Capacity of "Dyna-Switch" can be set to cut off at any load between 500 and 10,000 pounds. Breaking strength of the eyebolts is 29,000 pounds. 115

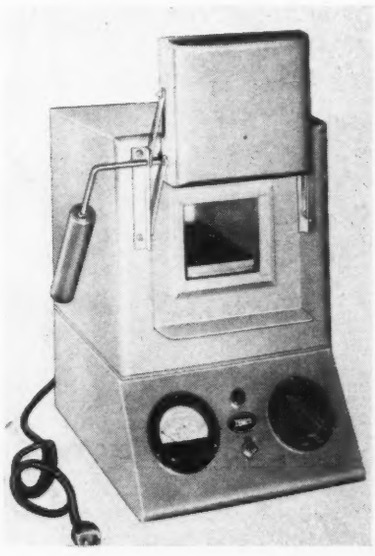






Williams Light-Weight Combination Vise Stand and Pipe Bender

Aluminum-alloy vise stand designed to combine the advantages of rigidity and strength with light weight. Two pipe benders are provided, one for pipe sizes up to 1/2 inch and the other for sizes up to 3/4 inch. Legs can be folded and held together for transportation with a permanently attached chain. Stand includes Williams No. 1 Vulcan pipe vise which will handle pipe sizes from 1/8 inch to 2 inches. Brought out by J. H. Williams & Co., 400 Vulcan St., Buffalo 7, N. Y. 116



Bench Type Temco Electric Furnace

New bench type electric furnace with "Temcometer" stepless temperature controller built into instrument panel housing in the base. Any input current from 5 to 100 per cent time "on" and any desired temperature from 350 degrees F. to maximum can be selected and held by adjusting the control knob. Can be operated continuously at temperatures up to 1650 degrees F. and intermittently to 1900 degrees F. This furnace is adapted for hardening and tempering small steel parts and tools, as well as for general laboratory work. Built in two chamber sizes—4 inches

To obtain additional information on equipment described on this page, see lower part of page 228.

Boost net output per machine

Install AUTOMATIC ROD MAGAZINES on your Brown & Sharpe Automatics

3 EFFICIENCY-BOOSTING ADVANTAGES

- Magazine inserts bar automatically as needed . . . in minimum amount of time.
- Greatly simplified restocking provides ample time for operator to supervise quality and finish of work more closely . . . and on more machines.
- Increased net production more nearly approaches gross or geared output.

BROWN &

BETTER WORK — LOWER COSTS

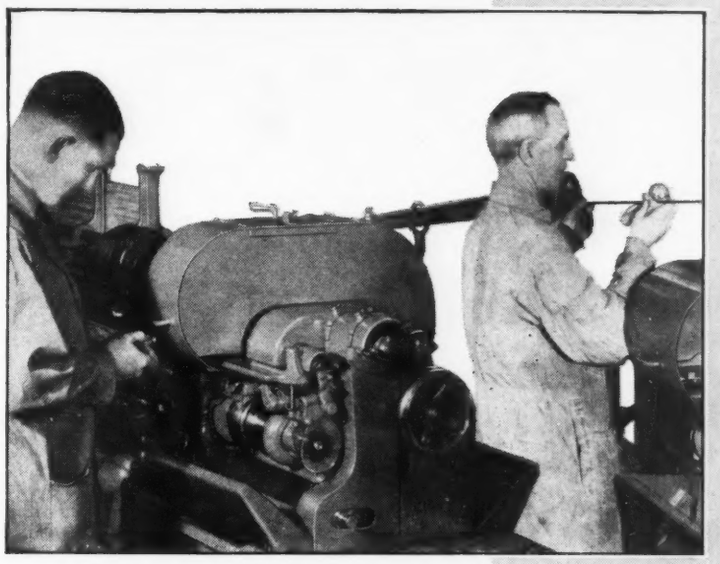
With the Automatic Rod Magazine, a screw machine operator is free to check work pieces more frequently and to pay closer attention to tool conditions . . . maintaining desired quality and producing parts at a minimum cost.

INCREASED OPERATING EFFICIENCY

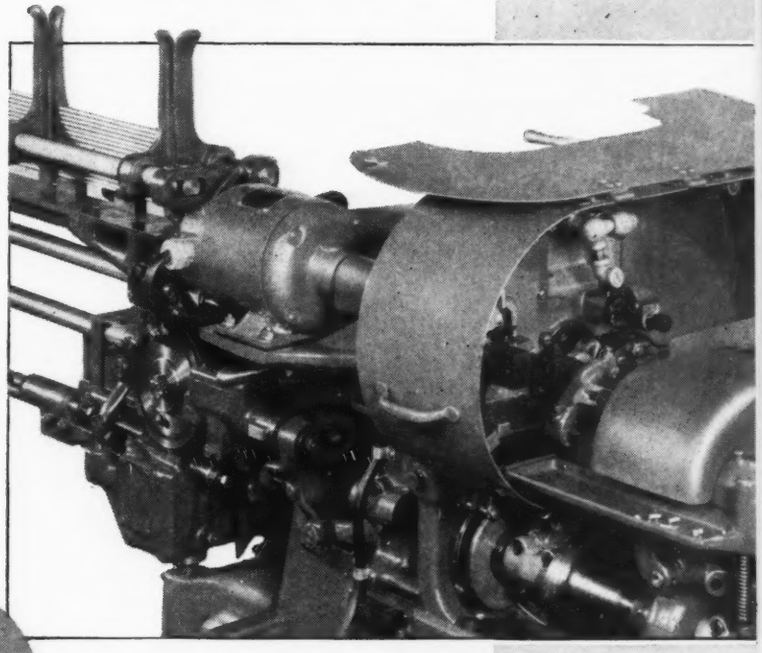
Here's how the Brown & Sharpe Automatic Rod Magazine increases operating efficiency. (1) The magazine permits loading of stock at any time (2) The feeding mechanism takes a new rod automatically the instant it's needed and feeds it into position for trimming.

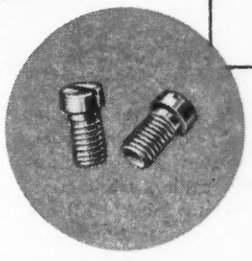
Electrically-controlled magazines are made for Brown & Sharpe Nos. 00G and 0G Automatic Screw and Cutting-Off Machines . . . also for Automatic Screw Threading Machine. Mechanically-operated magazine is made for No. 2G Machine. Magazines take commercial 10 ft. bars; 12 ft. capacity available.

Investigate the production advantages of Automatic Rod Magazines for your plant. Send for complete information. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



Compare the value of these screw machine operators. In foreground, operator utilizes his skill to full capacity because his machines are equipped with Automatic Rod Magazines that require infrequent stocking. Other operator must spend much of his time restocking — less time on tool maintenance and quality of work.

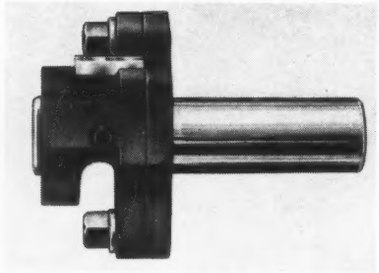




Every 3½ minutes this Automatic Screw Threading Machine consumes a 10 ft. bar, ¼" diam., in making screws like those shown at left. Its Automatic Rod Magazine holds 33 of these bars — two hours' supply. Magazine can be reloaded any time during this period. Without magazine, reloading involves over 15 interruptions an hour, making operation of more than two machines and close work-supervision difficult for one operator.

SHARPE B·S

wide, 3 1/2 inches high, and 4 1/2 inches deep; and 4 inches wide, 3 1/2 inches high, and 9 inches deep. Separate models are supplied for operation on 115 and 230 volts. Manufactured by Thermo Electric Mfg. Co., 507 W. Locust St., Dubuque, Iowa. 117

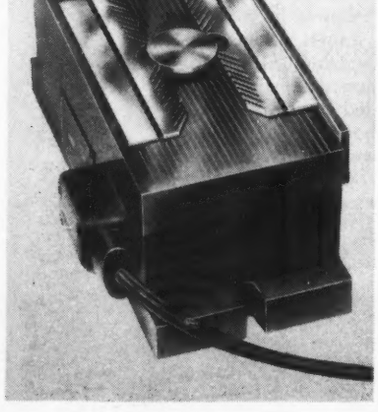


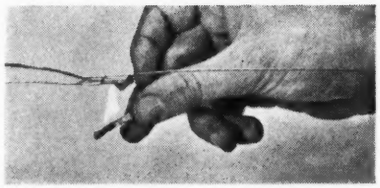
Boyar-Schultz Adjustable Pointing Tool

Universally adjustable pointing tool designed for use on screw machines. Adapted for producing conical, spherical, and specially shaped points on round or cylindrical work. The same tool can be used for right- or left-hand work. Four set-screws provide for adjusting the tool bit from right or left. Can be adjusted to compensate for misalignment between turret and spindle. The special rectangular flat tool bit can be ground with four shapes, all of which can be sharpened by taking a cut on the flat side. Made by the Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12, Ill., in capacities of 3/8, 5/8, and 7/8 inch. 118

Magnetic Clamping Device

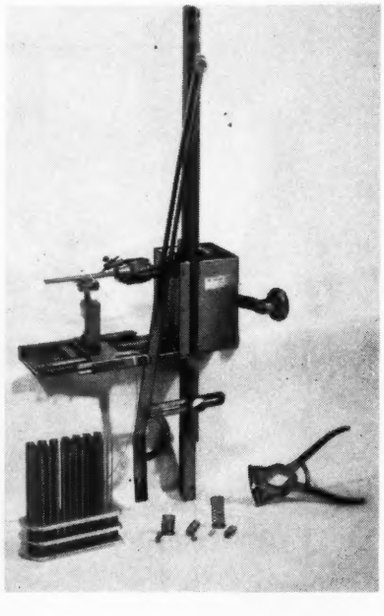
"Magna-Vise," consisting of a pair of magnetically actuated clamps, so designed that pieces of non-magnetic materials can be located between the jaws and held firmly against the face of the magnetic chuck for machining purposes. Manufactured by Hanchett Magna-Lock Corporation, P. O. Box 816, Big Rapids, Mich. 119





Low Melting Point Solder

Low melting point solder of 3/8-inch wide ribbon type containing a flux, which is said to be as easy to use as "Scotch Tape." Announced by the Proved Products Mfg. Co., San Fernando, Calif. Just the amount of solder needed can be easily placed on the work and heat applied by a match or a soldering iron to complete the operation. The resulting connection is said to have neat appearance, strength, and penetration. Can be used for soldering close to low-melting temperature plastic insulation such as used for coaxial cable and other radio, television, or field work where electrical outlets are not available. It can also be used for model building. 120

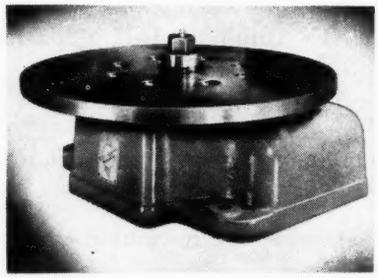


Spring-Coiling Machine

Semi-automatic machine for winding both left- and right-hand compression, extension, and torsion springs. Especially designed for coiling small quantities of springs (up to about 100) and for making sample springs. Can be set up in a few minutes. Springs can be wound from spring steel, music wire, stainless steel, phosphor bronze, or other materials. Equipped with an arbor rack containing twenty-five arbors made from ground, polished, and hardened drill rods in sizes ranging from 1/16 to 1/2 inch in diameter. Machine is hand-operated, but can be furnished with a motorized unit if desired. Placed on market by the Carlson Co., 277 Broadway, New York 7, N. Y. 121

Ettco Indexing Fixture

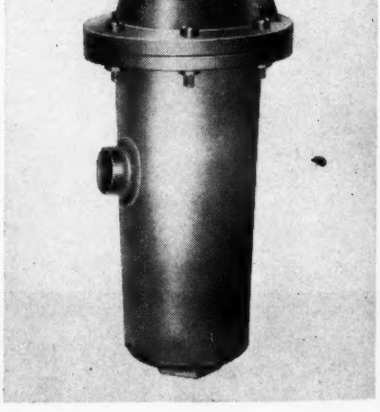
Electric indexing fixture brought out by the Ettco Tool Co., 592 Johnson Ave., Brooklyn 6, N. Y. This fixture, known as the Ettco-Emrick No. 97, is designed



for accurate and rapid indexing of work-pieces on punch presses, tapping machines, drill presses, and similar machines. Table indexing motions are controlled electrically through a modified Geneva motion system to assure smooth, shockless action. At each station the table is accurately locked in place by a hardened locating pin. A built-in electric control automatically synchronizes the movement of the spindle and the table and also controls the downward motion of the spindle. Available with interchangeable indexing plates ranging from 10 to 14 inches in diameter. 122

Automatic Air-Line Drain Valve

Drain valve for automatically draining off all water and oil, together with dirt, rust flakes, or other abrasive matter, from compressed air lines. Especially adapted for such applications as impact wrenches, pneumatic drills, hammers, riveters, screwdrivers, rotary grinders, and spray guns. Will handle from 0 up to 28 cubic feet of air per minute at a pressure of 100 pounds per square inch. Available from Wilkerson Valve, Inc., 260 S. Dale St., Denver, Colo. 123



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NEW CATALOG

Here is the latest information on low cost machining. This 32-page, heavily illustrated catalog contains complete specifications and features of Cincinnati Shapers. Many practical and useful shop applications are illustrated. Cincinnati Shapers give you maximum versatility with minimum investment and minimum tooling cost. Write for your copy.

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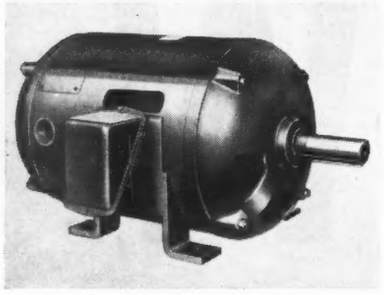
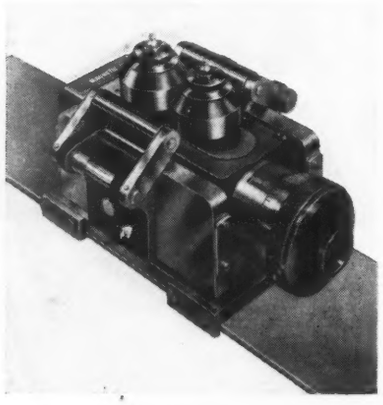


Crocker-Wheeler Motor

Protected type wound-rotor motor, built by Crocker-Wheeler Electric Mfg. Co., Division of Joshua Hendy Corporation, Ampere, N. J., in NEMA frames 224-505 in ratings up to 100 H.P. and in larger frame sizes up to 2000 H.P. Frames and end-shields are drip-proof. Also available in splash-proof and totally enclosed non-ventilated types. They are made for both horizontal and vertical operation. Especially adapted for applications requiring smooth acceleration, high starting torque with low starting current, and ability to start and stop or reverse frequently, or operate at variable speeds. 124

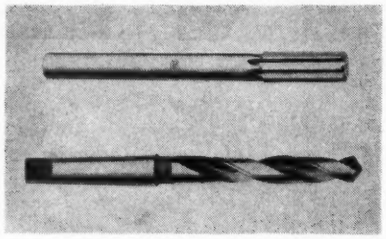


"Magnetic" Continuous Width Gage

Model B "Magnetic" continuous width gage consisting of a gage head, slide base, meter, and power unit, brought out by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn. This gage was designed to indicate the diameter or width of a continuous roll of wire or thin strip metal as it is being processed, in order to insure holding the product to a uniform size. The gage head has two rolls which are in continuous contact with the wire or material as it passes through the gage guided by two leveling rolls under tension, which flatten out the material and control the passage of the work in such a manner that a true measurement is always indicated. Can be used with a control meter to signal the operator or to automatically make corrective adjustments to maintain the predetermined size. 125

Besly High-Speed Drills and Reamers

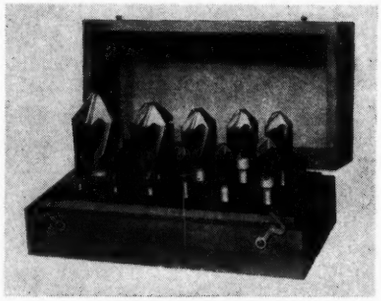
High-speed twist drills and reamers recently added to the line of tools manufactured by Charles H. Besly & Co., 118-124 N. Clinton St., Chicago 6, Ill.



All styles and sizes of drills and reamers are available, the more popular kinds being carried in stock for immediate delivery. 126

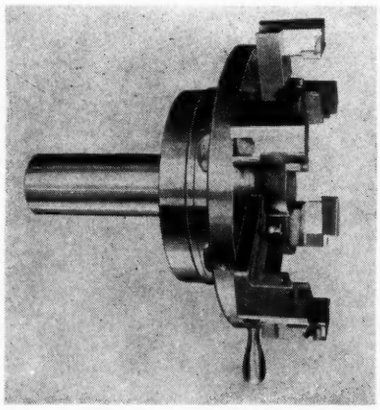
Lincoln "Fleetwelder"

Low cost, compact design, ease of operation, and reserve capacity are outstanding features claimed for this new model alternating-current "Fleetwelder," announced by the Lincoln Electric Co., Cleveland 1, Ohio, which has a NEMA rating of 200 amperes. The exclusive arc booster and exceptional reserve capacity of this unit make it well adapted for both job shop and industrial welding. It will handle a wide range of work in thick as well as thin material. Electrodes from 5/64 to 1/4 inch diameter can be used. Continuous fine adjustment of the welding current throughout the complete range is obtained by turning the control handle. A conveniently positioned dial indicates the current setting. The entire unit is enclosed in a pressed-steel case 25 inches high and weighs 319 pounds. Can be equipped with wheels for portable use. 127



Grobet Chatterless Countersinks

Chatterless 41-degree countersinks manufactured by the Grobet File Co. of America, Inc., 421 Canal St., New York 13, N. Y., now being supplied in specially designed strong wooden boxes that hold each size separately and securely for proper storage and ready use. Three different sets are available, with countersinks ranging in size from 1/4 inch to 2 inches in diameter, having 30-, 41-, and 45-degree angles with the center line. Special sets of 50-, 55-, and 60-degree angles can also be provided. 128



Landmatic Die-Head for Threading Valve-Seat Rings

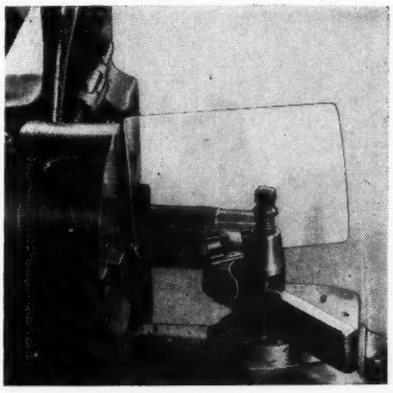
Internal-trip die-head for threading valve-seat rings up to 14 3/4 inches in diameter. Developed by the Landis Machine Co., Waynesboro, Pa. This die-head is normally furnished without the internal trip when the valve-seat rings are chucked and faced in accurate relationship to the chuck. With this arrangement, the stops on the turret can be set so as to allow the normal pull-off action to trip the die-head. For thread sizes larger than 9 15/16 inches in diameter, a large closing ring is mounted on the head to support the over-size chaser-holders. Varying thread lengths of different valve-seat rings can be accommodated. Six chasers which have a 30-degree short roughing and finishing throat are used per set. The coarsest pitch recommended is eight threads per inch. The chaser-holders have a

To obtain additional information on equipment described on this page, see lower part of page 228.

diametrical adjustment of approximately 5/8 inch on the larger size. This permits the same chaser-holders and chasers to be used for different diameters. 129

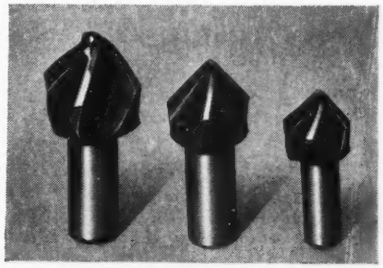
Lathe Shield

Plexiglas lathe shield made by Frank Gradischnig Co., 2417 N. Cramer, Milwaukee 11, Wis. Designed for easy attachment to tool-holder by means of a spring clip. This shield is 3 inches high by 5 inches wide, permitting the operator to have a full view of all cutting operations and eliminating the need for goggles. Easily adjustable to any position, it deflects and concentrates all chips and shavings, making it easier to clean the lathe. Available for 1/4-, 3/8-, and 1/2-inch tool-holders. 130



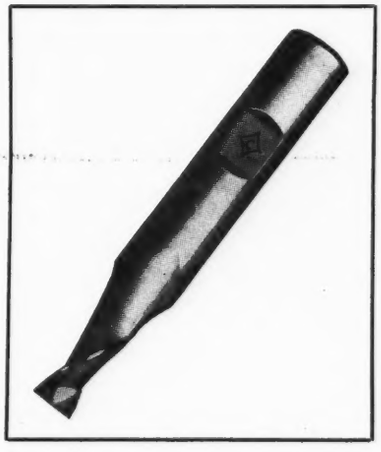
Completely Automatic Small-Parts Cleaning Machine

Completely automatic small-parts cleaning machine, furnished with baskets, dividers, and basket inserts, as well as with a quantity of cleaning and rinsing solutions, by the L & R Mfg. Co., 577 Elm St., Arlington, N. J. The parts to be cleaned are simply placed in the most suitable basket or subdivision in the basket, the basket is snapped on the motor shaft, and the starter button pressed. The parts then pass automatically through the cleaner, rinses, and drying chamber. The cleaning operation is completed in twelve minutes. 131



Severance Countersinks

Three of a set of six "chatter-free" countersinks known as "Econo-Sinks," made by Severance Tool Industries, Inc., 636 Iowa St., Saginaw, Mich. These countersinks come packed in a convenient container, with a separate space for each of the six sizes, which range from 1/4 to 1 inch, inclusive. The countersinks are available with angles of 30, 41, and 45 degrees with the center line. They are made of high-speed steel, and can be reground by the manufacturer at a fraction of their original cost. 132

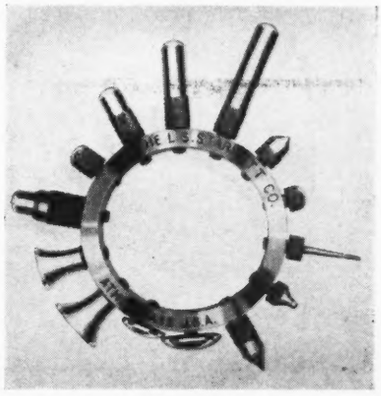


Cleveland Redesigned End-Mills

Improved end-mill of redesigned line developed by the Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio, to combine greater strength with higher speed and increased accuracy. Outstanding features and advantages claimed include redesigned and polished flutes with no pockets to prevent free movement of chips; closer control of size as a result of better clearance and accurately formed and polished flutes; maximum amount of metal where strength is needed; and no sharp corners or points where localization of stresses might occur. 133

Starrett Dial-Indicator Point Selector

Dial-indicator point selector with fourteen frequently used interchangeable dial-indicator contacts in a convenient package for use by inspectors, machinists, tool engineers, and others who make frequent use of dial gages. The choice includes a range of four standard 13/64-inch diameter points, 1/4, 1/2, 3/4, and 1 inch long; nine special shapes for measuring in holes or restricted places or for gaging on small resilient or rough surfaces; and a shock-absorbing point with an internal spring and telescoping anvil which protects the indicator from sudden shock or blows. The points are precision-made from high-grade steel, hardened, ground, and chrome-plated. Made by L. S. Starrett Co., Athol, Mass. 134

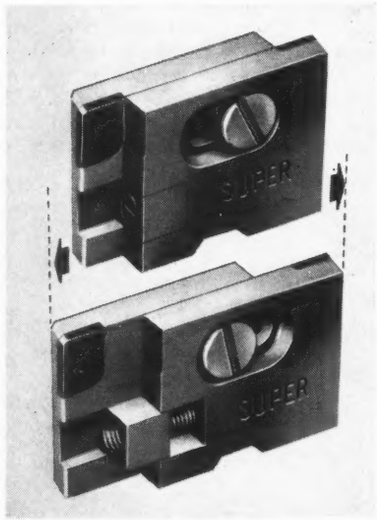


Indicating Snap Gage

New Model 1000 dial indicating snap gage designed to enable the operator to observe how the machining operation is progressing and to warn him when the work is nearly to size, so as to give him time to reset the machine or tool. One of the most important features of this gage is that it can be used in practically the same manner as conventional "Go" and "No Go" gages. All size adjust-

To obtain additional information on equipment described on this page, see lower part of page 228.

ments can be made with a screwdriver. The dial indicator has a cushioned movement, and can be faced in any position for machine or bench use. It is protected from dirt and coolant and has tungsten-carbide tipped upper and lower contacts. Five sizes cover all dimensions from 0 to 6 inches. Made by Federal Products Corporation, 1100G Eddy St., Providence 1, R. I. 135

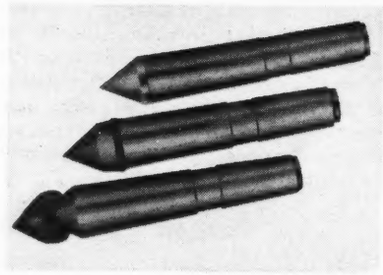


Carbide-Tipped Expansion Blades

Carbide-tipped adjustable expansion blades for standard reamers and boring-bars, announced by Super Tool Co., 21650 Hoover Road, Detroit 13, Mich. Available in a wide range of standard sizes up to 4 inches. 136

Colmonoy Tips for Salvaging Worn Centers

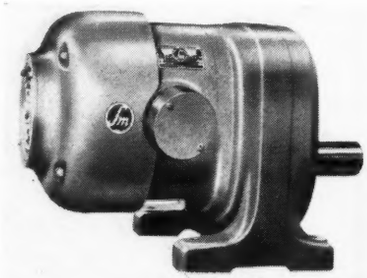
Colmonoy wear-resistant tips developed to eliminate the necessity for scrapping lathe or grinder centers when they are



worn back too far for further grinding. The wear-resistant tip or cap can be easily silver soldered to the worn end of the center. These tips are said to wear at least seven times longer between grinding than tips made of high-speed steel. Available in cast form or already applied to standard size centers and finish-ground from Diamonds and Tools Inc., Division of Wall Colmonoy Corporation, 19345 John R St., Detroit 3, Mich. 137

Sterling "Slo-Speed" Geared Motors

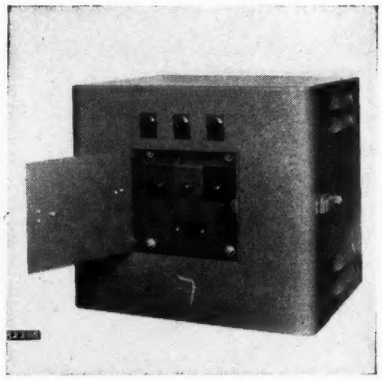
Improved "Slo-Speed" geared motor of "Klosd-Tite" construction for use in atmospheres containing non-explosive dust, vapors, and injurious foreign materials. An external fan forces cooling blasts of air over the streamline case of this new Type FWFB totally enclosed motor introduced by Sterling Electric



Motors, Inc., Los Angeles 22, Calif. Outstanding features include labyrinth seals, heavy-duty ball bearings lubricated for life, and Sterling patented herringbone rotor. Can be mounted in any position without modification. ..138

Westinghouse Weld Energy Comparator

New energy comparator designed to check weld energy consistency on applications where high-quality welds are imperative, as in the fabrication of high-alloy stainless steel used on jet engines. Gives a visible or audible, or visible and



audible signal. If desired, the unit can be interlocked with the welding machine to prevent further welding in case the weld energy is not within preset limits. Brought out by Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. It can be used with any Westinghouse single-phase spot welding control, and is provided with a sensitivity adjustment which can be set to any value required for the work, depending on the accuracy of the welding control unit. It detects changes in line voltage and changes in the duration of the welding current and is recommended for weld time ranges up to 30 cycles. 139

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in September, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME.....POSITION OR TITLE.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....STATE.....

This emulsion out-performs cutting oil

MACHINE:
No. 3A, Warner & Swasey Turret Lathe.

PART:
3" x 10" tapered flange, normalized S.A.E. 1040 steel forging.

OPERATIONS:
Drill 3" from solid, turn O.D., turn face, chamfer, tap tapered thread.

RESULTS:
With an emulsion of Texaco Soluble Oil Heavy Duty, threading speeds were same as when sulphurized cutting oil was used, but threads produced were smooth and passed critical inspection, machine output was increased, unit costs were reduced. Finish on all operations was excellent.

Texaco Soluble Oil Heavy-Duty increases machine output, reduces unit costs. Assures cleaner plant.

Emulsions made with *Texaco Soluble Oil Heavy Duty* are out-performing straight cutting oils on many jobs, such as broaching, drilling, turning and threading. They cool the work better, assure faster production and longer tool life.

In addition, there is less carry-off from emulsions with *Texaco Soluble Oil Heavy Duty*. This means savings in material consumption as well as in clean-up expense. These emulsions are highly stable and are not affected by normal contamination with the machine lubricant.

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils*. A Texaco Lubrication Engineer will gladly help you select the right ones to give you greater output and lower costs whatever the metal or your method of machining it. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 234 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the September, 1949, Number of MACHINERY

Steel Handbook

CLIMAX MOLYBDENUM CO., 500 Fifth Ave., New York 18, N. Y. 70-page booklet entitled "Three Keys to Satisfaction," containing technical information on the design of steel parts, including the choice of the proper steel for various requirements, and preferred treatments for different grades, such as cold-shearing, annealing, cold-heading, machining, hardening, carburizing, nitriding, etc. 1

Ex-Cell-O Anniversary Booklet

EX-CELL-O CORPORATION, 1200 Oakman Blvd., Detroit 32, Mich. Booklet entitled "Ex-Cell-O in the Land of Opportunity," commemorating the thirtieth anniversary of the corporation. The history and development of the company are outlined, and its current facilities, personnel, and operations described. 2

Polishing, Buffing, Grinding and Deburring Equipment

HAMMOND MACHINERY BUILDERS, INC., 1614 Douglas Ave., Kalamazoo, Mich. Catalogue 60, covering polishing and buffing lathes, abrasive-belt grinders and polishers, contour and cylindrical finishing machines, backstands, and automatics for use with polishing lathes or abrasive-belt machines. 3

Welding Data

EUTECTIC WELDING ALLOYS CORPORATION, 40 Worth St., New York 13, N. Y. Bi-monthly bulletin entitled "Welding Notes for Engineers," containing case histories of difficult problems of repair and construction and their solution, together with recommendations on the particular welding rod to be used for each job. 4

Abrasive Wheels

SIMONDS ABRASIVE CO., Philadelphia 37, Pa. Circular describing a new kind of abrasive wheel known as the "Fibrex Red Wheel," recently developed by the company and made in two types—depressed center wheels for portable machines, and straight wheels for cut-off machines and all-purpose use. 5

Steel Weldirectory

LINCOLN ELECTRIC CO., Cleveland 1, Ohio. Bulletin 462, entitled "Lincoln Weldirectory for Mild Steel and Low-Alloy High-Tensile Steels," containing instructions for the selection of the proper electrodes for welding various materials and types of work, together with the correct welding procedures. 6

Fluids and Lubricants

CARBIDE AND CARBON CHEMICALS CORPORATION, 30 E. 42nd St., New York 17, N. Y. Bulletin 6500, describing the various types of Ucon lubricants applicable to many types of machines, gears, internal combustion engines, etc. Information is also contained on the different uses of Ucon hydraulic and other fluids. 7

Lifting Device for Bulky Work

PUCEL ENTERPRISES, INC., 3746 Kelley Ave., Cleveland 14, Ohio. Circular illustrating and describing a multi-purpose tool known as the "Gonser Grizzly" lifter, designed to facilitate the handling of bulky and awkward-shaped materials. 8

Hydraulic Straightening Presses

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio. Bulletin 4902, descriptive of the new H-P-M two-way, all hydraulic straightening press for multiple straightening operations on large weldments, structural shapes, forgings, castings, and plates. 9

Bolster Plates

DANLY MACHINE SPECIALTIES, INC., 2100 S. 52nd Ave., Chicago 50, Ill. Folder on Danly bolster plates, including dimensional data on the new J.I.C. bolster plates, standardized in accordance with Joint Industry Conference specifications to facilitate die interchangeability. 10

Precision Boring Machines

NEW BRITAIN-GRIDLEY MACHINE DIVISION, NEW BRITAIN MACHINE CO., New Britain, Conn. Catalogue illustrating and describing the construction and operation of the company's new cam-actuated precision boring machines for straight or contour turning and boring. 11

Vibration Testing and Control Equipment

M B MFG. CO., INC., 1060 State St., New Haven 11, Conn. Catalogue containing data on vibration isolators and testing equipment, including a time-saving chart for use in locating the points on products at which mountings provide the greatest degree of vibration isolation. 12

Blanks for Carbide Tools

CARBOLOY COMPANY, INC., 11147 E. Eight Mile Blvd., Detroit 32, Mich. Supplement 8 to the company's tool catalogue, listing sizes and prices for its new line of standard blanks for pulley grooving tools and improved, heavy-duty lathe and grinder center blanks. 13

Small, Precision Tubing

PRECISION TUBE CO., INC., 3824 Terrace St., Philadelphia 28, Pa. Circular describing the characteristics and applications of the precision seamless tubing made by this company, which is available in sizes down to 0.010 inch outside diameter and 0.0015 inch wall thickness. 14

Cylindrical Grinders

LANDIS TOOL CO., Waynesboro, Pa. Bulletin S-49, describing and illustrating the new low-cost Grindwell general-purpose, universal cylindrical grinder, suitable for manufacturing, maintenance, tool-room, and training purposes. 15

Midget Mills

SEVERANCE TOOL INDUSTRIES, INC., 636 Iowa Ave., Saginaw, Mich. Catalogue 17, containing dimensional data and list prices covering the company's line of Midget high-speed steel, cemented-carbide, and other mills, together with suggestions for their use. 16

Pressure Regulators

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. 32-page catalogue illustrating and describing the company's line of pressure regulators, regulator adapters, and pressure gages. Flow and pressure charts are included. 17

"Controlled-Air-Power" Drill Press Feeds

BELLOWS CO., 222 W. Market St., Akron, Ohio. Bulletin DF-105R, describing "Controlled-Air-Power" feeds for drill presses and other machine tools. Actual installations on a variety of work are shown. 18

Rotary Storage Bins

FRICK-GALLAGHER MFG. CO., 400 Shubert Bldg., Philadelphia 2, Pa. Catalogue 106-A, descriptive of circular, rotating-shelf bins for storing parts and tools, known as "Rotabins," which are designed to save floor space and provide faster tool service. 19

Rotary Surface Grinders

MATTISON MACHINE WORKS, Rockford, Ill. Bulletin 144-2RM, illustrating and describing the No. 24 rotary surface grinder formerly manufactured by the Hanchett Mfg. Co. Typical production data on actual jobs is included. 20

V-Belt Drives

T. B. WOOD'S SONS CO., Chambersburg, Pa. Catalogue 192, comprising 96 pages of information on the company's line of "Sure-Grip" V-belt drives. Engineering data and suggestions for selecting the correct type of drive are included. 21

Precision Force Measuring Indicator

HUNTER SPRING CO., Lansdale, Pa. Circular illustrating and describing the Hunter precision force measuring indicator, and containing complete operating instructions. 22

Heavy Steel Plate

BY-PRODUCTS STEEL CO., DIVISION LUKENS STEEL CO., 183 Strode Ave., Coatesville, Pa. Circular announcing a new warehousing service for immediate delivery of heavy steel plate stock. 23

Ball-Bearing Lubricants

DOW CORNING CORPORATION, Midland, Mich. "Silicone Notes" Nos. D-5 and D-6, describing the properties of Dow Corning silicone greases, and their performance and use as ball-bearing lubricants. 24

Self-Lubricating Bearing Material

WEL-MET CO., 124 Gougler Ave., Kent, Ohio. Catalogue 102, on self-lubricating bearing materials for small-lot requirements; also includes sizes of finished powdered-metal bearings. 25

Weighing Equipment

HYDROWAY SCALES, INC., 7632 Fenkell Ave., Detroit 21, Mich. Circular descriptive of the "Hydroscale," a scale of new design for use with cranes and chain hoists, which weighs the load as it is being lifted. 26

Steel Castings

STEEL FOUNDERS' SOCIETY OF AMERICA, 920 Midland Bldg., Cleveland 15, Ohio. 34-page booklet describing the versatility, strength, and dependability of steel castings and their performance in exacting service. 27

Non-Corrosive Indicating Gages

STAR BRASS MFG. DIVISION, WILLIAMS & HUSSEY MACHINE CO., INC., Wilton, N. H. Circular illustrating and describing the Star line of "Superbronze" non-corrosive indicating gages. 28

Cranes

SILENT HOIST & CRANE CO., INC., 841-877 Sixty-third St., Brooklyn 20, N. Y. Bulletin 89, entitled "How Krane Kar Cuts Materials-Handling Costs in the Metal-Working and Metal-Producing Industries." 29

Machines and Tools for Sheet-Metal Work

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo 11, N. Y. Booklet 200-G, describing machines and tools for use in sheet-metal shops. 30

Ball and Roller Bearings

GWILLIAM CO., 360 Furman St., Brooklyn 2, N. Y. Catalogue 25, covering the Gwilliam line of roller thrust and ball thrust bearings, step bearings, journal roller bearings, and special bearings. 31

Heavy-Duty Lathes

MONARCH MACHINE TOOL CO., Sidney, Ohio. Catalogue describing the features of construction of Monarch heavy-duty lathes and auxiliary equipment, including duplicating devices. 32

Core-Drill Cutters

SCULLY-JONES & CO., 1906 S. Rockwell St., Chicago 8, Ill. Folder containing prices and specifications covering the company's new line of high-speed steel core-drill cutters. 33

Centrifugal Switches

EUCLID ELECTRIC & MFG. CO., Madison, Ohio. Bulletin B 1001,

describing a new and improved centrifugal switch for application on machine tools, conveyor systems, fans, motors, etc. 34

Metal Heads

LUKENS STEEL CO., Coatesville, Pa. Circular outlining nine advantages of using Lukens prefabricated metal heads and shapes in the design of machines or parts. 35

Corrosion-Resisting Sheet and Plate

DURIRON CO., INC., Dayton 1, Ohio. Bulletin 502, containing information on Durimet 20 corrosion-resisting sheet and plate for laboratory equipment. 36

Precision Control Valves

KOHLER CO., Kohler, Wis. Catalogue containing 20 pages of engineering data on precision control valves, fittings, and special parts for the aircraft, automotive, and other industries. 37

Copper Alloys

CERRO DE PASCO COPPER CORPORATION, 40 Wall St., New York 5, N. Y. Folder J4-6, listing applications and physical properties of low-temperature melting Cerro alloys. 38

Blast Cleaning

AMERICAN WHEELABRATOR & EQUIPMENT CORPORATION, 555 S. Byrkit St., Mishawaka, Ind. Bulletin 584, entitled "How Wheelabrating Has Replaced Acid Pickling." 39

Hard-Rubber Molded Parts

AMERICAN HARD RUBBER CO., 11 Mercer St., New York 13, N. Y. Folder entitled "How to Recognize a Job for Hard Rubber," listing typical uses of hard rubber and plastic parts. 40

Flexible Chain Couplings

MORSE CHAIN CO., 7601 Central, Detroit 8, Mich. Catalogue C45-49, containing dimensions, horsepower ratings, and other data on the company's line of flexible chain couplings. 41

Visual Planning Models

VISUAL PLANNING EQUIPMENT CO., INC., Pennsylvania Ave. at River, Oakmont, Pa. Catalogue on the visual planning models and equipment made by the company. 42

Metal Stampings

DAYTON ROGERS MFG. CO., Minneapolis 7, Minn. Circular announcing the small-lot metal-stamping service offered by this company. 43

Steel Pipe Plugs

J. J. TOUREK MFG. CO., 4710 W. 16th St., Chicago 50, Ill. Catalogue announcing a new line of precision-made steel pipe plugs, including specifications and prices. 44

"Uniclosed" Motors

U. S. ELECTRICAL MOTORS, INC., 200 E. Slauson Ave., Los Angeles 54, Calif. Bulletin 1524, describing the features of the U. S. "Uniclosed" motor. 45

Screw Machine Collets

SUTTON TOOL CO., Department 000, Sturgis, Mich. Catalogue 17, containing 24 pages of data on screw machine collets and special tools. 46

Self-Locking Nuts

PALNUT CO., Irvington 11, N. J. Leaflet descriptive of Palnut Acorn "Pushnuts" for 1/4-inch unthreaded rod. 47

* * *

New Coil Weight Calculator

A coil weight calculator that permits quick, easy calculation of the exact weight of steel coils has been devised by the F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago 13, Ill. On the back of the device is a handy sheet-gage table and complete listing of all sizes of Littell reels. By the use of this calculator, a foreman can choose the correct size of reel required for any size or weight of coil. The calculators will be sent without charge upon request to the company.

* * *

As industrial relations programs seldom extend to those retired from active employment, the creation of a newly formed retired employes club at the Farrel-Birmingham Co., Ansonia, Conn., is noteworthy. A former patternshop building has been converted into offices for the club. The usual club room appointments are provided, including comfortable lounges and chairs, a library and table games.

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (September, 1949) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

NAME.....**POSITION OR TITLE**.....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

FIRM.....

BUSINESS ADDRESS.....

CITY.....**STATE**.....

By E.S.S.

BETWEEN GRINDS

And Society is Soy?

We looked around the office for a logical contender to answer a letter from a foreign correspondent which began "Dear Coy." Until we realized the writer had simply abbreviated the word company to coy.

A Shade Overdone

One of the advertising agencies announced in the mail a two weeks' vacation, during which time painters and carpenters were taking over the premises. A skeleton force was being maintained, however, and an amusing drawing showed a skeleton sitting before a typewriter answering the telephone, while workmen in various stages of stalling and labor surrounded him. But we looked closely at the skeleton —it was during the summer heat wave and we wanted to get an idea of how we too would appear at our desk if the wave continued.

Aesop in Economy Land

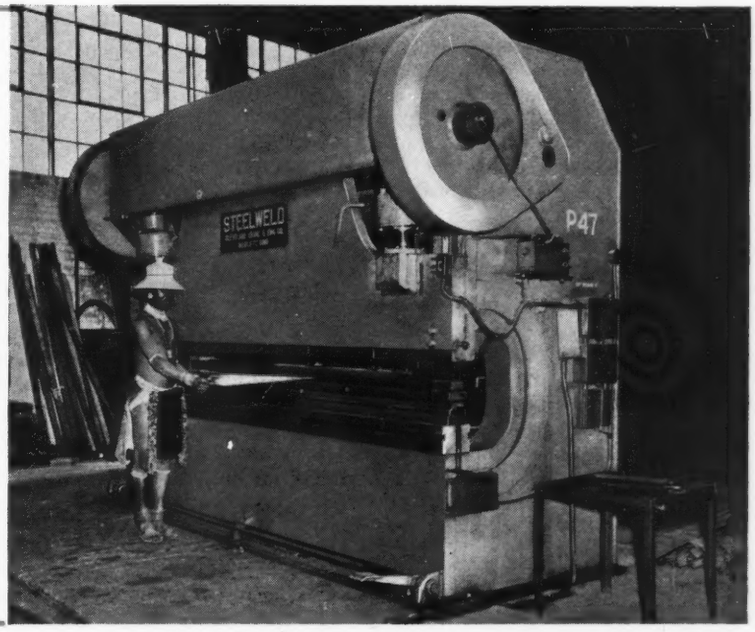
William J. Casey, economist and "Steelways" contributor, spins his "Fable of the Free Lunch" in their July issue. Seems an ancient king, troubled by the economic woes of his people, called upon the economists of his kingdom for advice. Months elapsed, and one by one, the economists presented the king with lengthy tomes replete with charts and graphs, instead of the short, simple texts he had requested. In fury, the King banished these experts. Then a straggler appeared before the King, in fear and trembling. "Your Majesty," he quavered, "I have reduced this subject of economics to nine words: There is no such thing as a free lunch."

Spanish Acrostic

One of these days you may be riding in an ACF-Talgo train, the result of a Spaniard's interest in evolving simpler and lighter railroad equipment and the American Car and Foundry Co.'s interest in resolving it. As you flash the word Talgo around you may like to know the meaning, supplied by *Wheels:*

T tren: train.
A articulado: jointed.
L ligero: light.
G Goicoechea: the inventor.
O Oriol: Spanish industrialist who backed "G" (with G's).

WELL-DRESSED WAGE-EARNER in DARKEST AFRICA—Native Zulu operating a Steelweld bending press in plant of Steel & Power Products, Ltd., Johannesburg, South Africa. Comments varied in our office: Must have run home and got into his Sunday clothes; his earrings were probably stamped on next machine; what, no safety shoes; his black apron could carry some advertising (this from a copywriter, naturally); probably a boy from Bayonne (that from a skeptic who can always spot a Hollywood Indian)



News of the Industry

California

EDWARD R. ANDERSON has been appointed vice-president of the Kellogg Division of the American Brake Shoe Co., New York City, with headquarters in San Francisco, Calif. Mr. Anderson has been connected with the company since 1930 in the engineering and sales departments of the Brake Shoe and Castings Division. He was made district sales manager of the Pacific district for this division in 1947, and will continue to serve in this capacity in addition to filling his new duties.

O. L. PRINGLE has been elected vice-president in charge of sales, and LAURENCE S. DAHL vice-president in charge of operations, of the Columbia Steel Co., San Francisco, Calif., a subsidiary of the United States Steel Corporation.

JOHN P. MCARTHUR has been appointed manager of West Coast sales for the Worthington Pump & Machinery Corporation, Harrison, N. J. His headquarters will be at San Francisco, Calif.

Illinois

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following executive changes: WILLIAM G. FINDLAY, former manager of the Pittsburgh plant, has been transferred to Chicago as manager of the Work Order Division for all Ryerson steel-service plants; A. L. PETERSEN, manager of the St. Louis plant, has been transferred to Pittsburgh to succeed Mr. Findlay; and JOHN M. ACEE, previously manager of sales at St. Louis, has been named manager of that plant to fill the post left vacant by Mr. Petersen.

CLEARING MACHINE CORPORATION, Chicago, Ill., manufacturer of presses, announces the appointment of the following new dealers: HARRINGTON-WILSON-BROWN CO., 405 Lexington Ave., New York 17, N. Y.; J. F. OWENS MACHINERY CO., 1804-1810 Erie Blvd., East, Syracuse, N. Y.; F. W. SCHIEFER MACHINERY CO., 39 State St., Rochester 4, N. Y.; and R. L. CRANE MACHINERY CO., 296 Delaware Ave., Buffalo 2, N. Y.

SCULLY-JONES & CO., Chicago, Ill., announce the formation of a Production Parts Division, to be headed by J. DUDLEY LOCKREM, vice-president. The new division, which is established primarily to serve the automotive and aircraft industries, will offer complete facilities for machining, heat-treating, grinding, subassembly, and inspection. It will also maintain an engineering staff to solve design and production problems for manufacturers.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., announces the purchase of the ROCKFORD MAGNETIC PRODUCTS CO., located at 9th St. and 18th Ave. The newly acquired company will be operated as a Sundstrand subsidiary under the name of SUNDSTRAND MAGNETIC PRODUCTS CO., and will continue to manufacture its line of magnetic holding devices at the present location.

HYDRO-LINE MFG. CO., Rockford, Ill., announces the appointment of the following agents for its line of air and hydraulic cylinders and special machinery: HYDRAULIC SERVICE CO., 7550 Mayland St., Philadelphia, Pa., and ALTON J. FABREY, 227 Fourth St., Scotia, N. Y.

WILLIAM CAMPBELL has been appointed sales representative for the LaSalle Steel Co., Chicago, Ill., covering part of Chicago and nearby territory.

BENJAMIN S. SAMPSON has been made manager of the Industrial Furnace and Oven Division of the Claud S. Gordon Co., Chicago, Ill.

Indiana

HARRY A. DENNIS has been appointed manager of sales in the midwestern area for the Weldment Division of the Graver Tank & Mfg. Co., Inc., East Chicago, Ind. Mr. Dennis was formerly assistant district manager of sales for the Lukens Steel Co.

E. W. CHAPMAN has been promoted to the position of assistant sales manager of the S. G. Taylor Chain Co., Hammond, Ind., manufacturer of industrial and automotive tire chains. S. N. MORISON has been made manager of industrial sales.

ARTHUR E. FOCKE, research metallurgist for the Diamond Chain Co., Indianapolis, Ind., has been chosen the next president of the American Society for Metals, Cleveland, Ohio.

Michigan

FEDERAL-MOGUL CORPORATION, Detroit, Mich., manufacturer of automotive engine bearings, announces the acquisition of the NATIONAL FORMETAL CO., Cleveland, Ohio, maker of rolled split bushings, bearings, spacers, and washers used in the automotive, appliance, and many other industries. The company will be operated as a division of the Federal-Mogul Corporation. No change in personnel is contemplated.

DETROIT BROACH CO., Detroit, Mich., announces the appointment of MILLER-BARBER ASSOCIATES, P.O. Box 974, New Rochelle, N. Y., and EARL W. KEIR, 2330 Clybourne, Milwaukee 3, Wis., as representatives of the company.

BUTTERFIELD DIVISION OF UNION TWIST DRILL CO., Derby Line, Vt., manufacturer of taps, dies, reamers, and special cutting tools, has appointed the BOND SUPPLY CO., 524 N. Rose St., Kalamazoo, Mich., and 54 Barney St., Battle Creek, Mich., distributor for the company.

EDWIN D. SCOTT, long associated with automotive body engineering in the Detroit area, has joined the Peninsular Products Corporation, Detroit, Mich., as chief engineer.

Missouri and Iowa

J. E. WHITE, 1802-1808 S. Seventh St., St. Louis, Mo., has been appointed distributor for HOBART BROTHERS, Troy, Ohio, and will operate under the name of HOBART WELDER SALES & SERVICE. This firm will distribute the complete line of Hobart arc-welding equipment, accessories and electrodes.

FRED H. PILLSBURY has been appointed vice-president in charge of operations of the Century Electric Co., St. Louis, Mo. He previously served in the capacity of executive engineer.

FRANK P. LEAHEY has been made executive vice-president of the Nichols Wire & Aluminum Co., Davenport, Iowa. He has been with the company since 1946, and was made a vice-president in 1947. Before becoming connected with the company, he was for many years with the American Steel & Wire Co.

Glenn H. Alberga, recently appointed plant manager of the Laminated Shim Co.

New England

GLENN H. ALBERGA has been made plant manager of the Laminated Shim Co., Glenbrook, Conn., manufacturer of shims, shim stock, stampings, and the "An-Cor-Lox" lock-nut. For the last seven years, Mr. Alberga has been general manager and chief engineer for the John J. Plocar Co., a consulting management engineering firm of Stamford, Conn.

HARTFORD SPECIAL MACHINERY CO., Hartford, Conn., announces the acquisition of three standard machinery lines for production in its Hartford plant. One of these is the special drilling machinery line formerly manufactured by the Langelier Mfg. Co. of Cranston, R. I. All the Langelier engineering personnel will be retained. The other two lines acquired by the company consists of an automatic thread-rolling machine and a die polishing machine.

L. S. STARRETT CO., Athol, Mass., has purchased the BURRILL SAW & TOOL WORKS, of Ilion, N. Y., manufacturers of Paramount band knives and band saws. These products are now being manufactured at the Starrett plant, and are being marketed under the Starrett name. The company has recently erected a new building, which increases to nine acres of floor space the company's facilities for manufacturing measuring tools and precision instruments, dial indicators, steel tapes, hacksaws, and band saws.

A. S. CAMPBELL CO., INC., Boston, Mass., manufacturer of metal stampings, has recently purchased the assets of the ROLLINS ENGINE CO., Nashua, N. H., manufacturer of special machinery. The new company will be known as the ROLLINS ENGINE & MACHINE CO., INC., and will maintain its present plant and organization, with RUSSELL L. SYLVESTER, the former owner, filling the positions of vice-president and general manager.

New York and New Jersey

L. B. DOBBINS has been appointed supervisor of plant engineering for the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. Mr. Dobbins, who was superintendent of the Johnstown tonnage oxygen plant, will be succeeded in that position by J. C. WHITE, former superintendent of the Gloucester, N. J., oxygen plant. Other personnel changes in the company are as follows: J. B. DAVENPORT, previously assistant manager of the Detroit district, has been appointed assistant manager of the Charlotte district; J. H. HART, formerly assistant sales manager at Detroit has been promoted to assistant manager of that district, while R. A. JAMIESON will assume the position vacated by Mr. Hart; and A. S. BLODGET, JR., has been appointed assistant manager of the Boston district.

HOWARD DAVIES has been assigned to the Syracuse, N. Y., district sales office of the Warner & Swasey Co., Cleveland, Ohio. Mr. Davies has been with the sales engineering department since 1939, and has been field engineer at Cleveland since 1940.

THORNDIKE SAVILLE, Dean of Engineering at New York University, was elected president of the American Society for Engineering Education for the year 1949-50 at the recent annual convention of the Society held at Rensselaer Polytechnic Institute in Troy, N. Y.

MARTIN R. KING has been appointed manager of the apparatus department news bureau for the General Electric Co., Schenectady, N. Y. He has been assistant manager since March, and succeeds C. P. FISCHER, JR., who has been named manager of a new promotional division.

ALFONS ALVEN has been appointed general sales manager of the Rollway Bearing Co., Syracuse, N. Y., a subsidiary of the Lipe-Rollway Corporation. He was previously president of the Bearings Co. of America, Lancaster, Pa.

GERALD H. KARLEN, 141 Broadway, New York City, has been appointed district representative in the metropolitan New York area and in the states of Connecticut, Rhode Island, and Massachusetts for the Westcott Chuck Co., Oneida, N. Y.

GILBERT W. CHAPMAN has been elected president of the Yale & Towne Mfg. Co., New York City, succeeding CALVERT CAREY, who resigned recently because of ill health. Mr. Chapman was previously vice-president in charge of finance.

R. E. BRYANT has been appointed manager of the automotive and electrical branch of the Wagner Electric Corporation at Buffalo, N. Y. He was previously located at the Pittsburgh branch office.

HARRY A. COOPER, president of the Cooper Alloy Foundry Co., Hillside, N. J., was elected president of the Alloy Casting Institute at the recent annual meeting in Colorado Springs, Colo.

Ohio

MALCOLM S. CLARK has resigned as president and member of the board of directors of the Federal Machine & Welder Co., Warren, Ohio. He has been succeeded by A. S. BLAGDEN of Nashville, Tenn., who was named executive vice-president of the company recently. Prior to joining the company, Mr. Blagden served as president of the Keesby & Madison Co., Philadelphia, Pa., and as president of the Beaver Products Co., Buffalo, N. Y. Mr. Clark, who had been president of the Federal Machine & Welder Co. since 1937, will spend some time in California. His future plans have not been announced.

AMERICAN STEEL & WIRE CO., Cleveland, Ohio, announces the following appointments: R. F. CURTIS, HOWARD B. MAGUIRE, and CLARENCE T. GILCHRIST have been promoted to the newly created positions of area managers of sales at New York, Cleveland, and Chicago, respectively, while the positions they vacated will be filled by NORMAN M. STED, manager of the manufacturers products sales division at the Cleveland headquarters; MAXWELL D. V. MILLARD, manager of the Detroit district sales office; and EDWARD A. MURRAY, manager of the Chicago district sales office.

FEDERAL MACHINE & WELDER CO. announces the consolidation of the operations of the Warco Press Division and the Welder Division in its Plant No. 2, located on Overland Ave. just beyond the city limits of Warren, Ohio. This plant was originally built for the manufacture of medium tanks and other wartime products. Since the war, it has been engaged in the manufacture of resistance welding equipment, press brakes, and other types of special machinery.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the following changes in its sales engineering

staff: E. E. GOEHRINGER has been made district manager in the Indianapolis area; OMER BLODGETT has been transferred from the Grand Rapids office to the Chicago office; R. L. HALL and ROBERT HIRSCH have been made district engineers at the Pittsburgh office.

WILLIAM H. COMPTON, who has served as manager of the Rockford, Ill., sales office of the Reliance Electric & Engineering Co. for the last four years, has been made supervisor of standard motor sales, with headquarters in the general office at Cleveland, Ohio.

WILLIS KUHLMAN, of the demonstration and service staff of the Monarch Machine Tool Co., Sidney, Ohio, has been sent abroad to supervise the installation of fifty-six Monarch lathes, many of which are equipped with special tooling, that have recently been shipped to European countries.

FERRACUTE MACHINE CO., Bridgeton, N. J., announces the appointment of C. R. TERRY, of the Terry Machinery Co., 808 Hanna Bldg., Cleveland, Ohio, as agent to represent the complete line of Ferracute power presses in northeastern Ohio, including the Cleveland area.

E. W. BLISS CO., Toledo, Ohio, announces renewal of its activities in the manufacture of semi-automatic container-making machinery. This machinery will now be designed, manufactured, and serviced from the company's Hastings, Mich., plant.

LEONARD G. DANIELS has joined the executive staff of Precision Metalsmiths, Inc., 6511 Cedar Ave., Cleveland, Ohio, as metallurgist, heading the newly created engineering design department.

L. H. FLORA has been named chief engineer for Tinnerman Products, Inc., Cleveland, Ohio, manufacturer of "Speed Nut" fasteners, and R. A. HARTMAN has been made manager of field engineering.

H. D. MCKINLEY has been appointed works manager of the new degreasing-solvent manufacturing plant being erected by Hooker-Detrex, Inc., at Ashtabula, Ohio.

Pennsylvania

ROBERT P. MELIUS and WILLIAM A. MARSTELLAR have been elected vice-presidents of the Rockwell Mfg. Co., Pittsburgh, Pa. Mr. Melius was recently placed in charge of sales for the newly created Power Tool Division of the company, which will market Delta, Crescent, Multiplex, and Delta-Homecraft wood- and metal-working tools. He has been connected with the Delta Mfg. Division for nineteen years, and has been sales manager of that division since 1935. Mr. Marstellar has been manager of advertising and market research of the company for several years, as well as vice-president of Edward Valves, Inc., East Chicago, Ind.

Robert P. Melius, in charge of sales of the new Power Tool Division, Rockwell Mfg. Co.

SKF INDUSTRIES, INC., Philadelphia, Pa., has recently enlarged its plant at Shippensburg, Pa., to provide additional facilities for the production of anti-friction bearing retainers. The enlarged facilities will enable the company to take over a substantial portion of the work now subcontracted.

AVARD W. TAYLOR has been appointed district manager of the Philadelphia and Reading territories for the Carpenter Steel Co., Reading, Pa. Mr. Taylor, formerly assistant manager, has been with the company for ten years. His office is located at 3701 N. Broad St., Philadelphia.

A. F. MACK has been appointed eastern sales representative for the Thomas Machine Mfg. Co., Pittsburgh, Pa., with headquarters in the Commercial Trust Bldg., Philadelphia, Pa. Mr. Mack has been associated with the company since 1942 in a production capacity.

FIRTH STERLING STEEL & CARBIDE CORPORATION, McKeesport, Pa., announces the following new appointments: C. R. HARMON, sales manager, Carbide Sales Division, and J. M. STOKES, assistant sales manager of that division; J. J. SOWKO, Pittsburgh branch sales manager.

SIMMONS MACHINE TOOL CORPORATION, Albany, N. Y., announces the reopening of its sales office in Philadelphia, Pa., located at 229 W. Upsal St. WILLIAM C. WERLEY, who has been connected with the New York office, returns to the Philadelphia office as manager.

GEORGE F. RITENBAUGH, who rose from office boy to secretary-treasurer of the Heppenstall Co., Pittsburgh, Pa., recently retired, after forty years of service, because of ill health. A dinner was given in his honor at the Duquesne Club in Pittsburgh upon the occasion.

ORRIN G. MEYERS has been appointed sales manager of the Hunter Spring Co., Lansdale, Pa. Mr. Meyers, formerly chief engineer for the company, succeeds WILLIAM J. TRENDLER, who recently resigned.

HUGO T. WILDER has been made manager of the newly established marketing division in the sales department of the Aluminum Co. of America, Pittsburgh, Pa.

Texas

H. G. ERICKSON has been appointed chief engineer of the Texas Engineering & Mfg. Co., Inc., Dallas, Tex., manufacturer of the TE-1A military trainer (Army designation T-35). He was previously chief engineer of the Luscombe Airplane Corporation.

JAMES R. HEWITT, JR., has been appointed Texas and southwestern representative for the Columbia Tool Steel Co., Chicago Heights, Ill. Mr. Hewitt's office is located at 1213 Capitol Ave., Houston, Tex.

DOLAN INDUSTRIAL SALES, Houston, Tex., have been appointed representatives for the DETROIT TAP & TOOL CO., the COLONIAL BROACH CO., and COLONIAL BUSHINGS, INC., all of Detroit, Mich.

Wisconsin and Minnesota

EDWARD W. WILSON has been transferred from the Chicago office staff of the Synthane Corporation, Oaks, Pa., manufacturer of laminated plastics for industrial use, to the Milwaukee office of the company, where he will serve as a direct sales representative, assisting HOWARD A. TYNER.

STANLEY J. RETZLAFF has rejoined the Allis-Chalmers Mfg. Co., Milwaukee, Wis., as manager of sales to machinery manufacturers.

P. H. BATTEN, chairman of the board of the Twin Disc Clutch Co., Racine, Wis., was awarded the degree of Doctor of Engineering by Purdue University at the commencement exercises in June. Mr. Batten

GEAR PRODUCTION HIGHLIGHTS

No. 104

Cutting-Shaving-Checking-Lapping

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

Job-Lot Gear Finishing in Mass Production Quantities

Where does "job lot" production of gears leave off and "mass production" begin? Canadian Acme Screw and Gear, Limited, Toronto, Ontario, has an answer: It doesn't. You can have both—at the same time. Its plant at Toronto provides the proof. Here, by a process of ingenious tooling and gear designing:

A. 25 gears for several different types of truck and agricultural equipment transmissions are turned out with just two cutters.

B. These 25, plus transmission gears—both spur and helical, single or cluster—for three popular light duty trucks and two passenger cars can be produced on the same machine with a total of just 12 quickly interchangeable cutters.

C. Each of these gears can be finished in a machine cycle time of only 20 seconds per gear.

Basic approach to achieving these results at Canadian Acme was two-fold and consisted of:

1. Designing gears so that a maximum number of types can be finished with the minimum number of cutters.
2. Selecting a finishing machine to give minimum cycle time and minimum time for tool changes.

A total of only 12 different cutters are required to shave 32 of the 39 gears shown in Fig. 1 which are shaved on the Michigan 870 (Fig. 2). The other seven are not shaved. Canadian Acme engineers have further standardized all the gears shown in Figs. 3 and 4 so that the two cutters shown will shave a majority of the total gears in the group. Gears at the left of Fig. 4 are all 8/10 pitch and 20 degree pressure angle.

Three types of rotary gear shavers have been and are in use at Canadian Acme. The latest machine (Fig. 2) is a Michigan Tool Company series 870 three-way machine ("underpass" shaving, "transverse" shaving, or "traverpass" shaving). Its key position in the production line is due to three factors:

1. Its ease of set-up permits rapid changeover from one gear to another (switches are made 3 or 4 times a day to take care of output of different gear cutting lines).
2. Longer tool life.
3. In some cases cycle time is shorter (20 seconds vs. 40 seconds on machine No. 2). In no case is cycle time longer.

For further information on Michigan series 870 gear shavers, write Michigan Tool Company, 7171 E. McNichols Road, Detroit 12, Michigan.

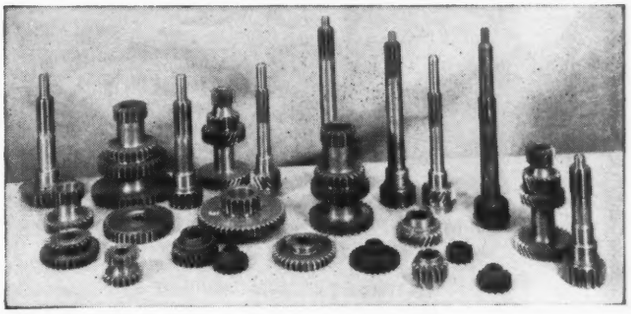


Fig. 1

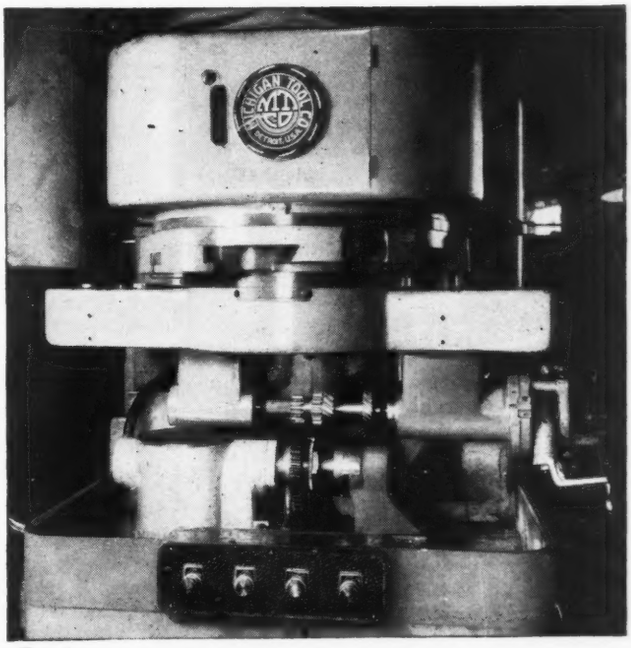


Fig- 2

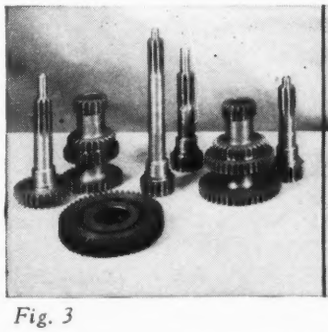


Fig. 3

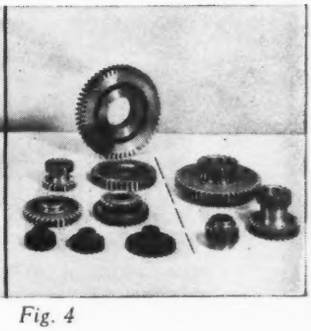


Fig. 4

Performance data on the Michigan No. 870 is:

Output.....110-120 gears per hour
Stock removed (over pins).....006-.008"
Gear material.....SAE 4620

Typical Approximate Tool Life

17 tooth, 1½" face gear..... 5000/grind
43 tooth, ⅝" face gear.....15000/grind

P. H. Batten, who was recently awarded the degree of Doctor of Engineering by Purdue University

was graduated from Purdue in the class of 1898. The citation accompanying his degree stated that he was "recognized as a leader in industry, a gifted administrator devoted to human values, and a citizen marked by unselfish service to his fellow men."

E. L. SANDBERG Co., 930 Pillsbury Bldg., Minneapolis 2, Minn., has been appointed sales representative in the state of Minnesota and western Wisconsin for the line of micrometer dial indicators and micrometer dial gages made by the B. C. AMES Co., Waltham, Mass.

AMPCO METAL, INC., Milwaukee, Wis., has appointed the W. P. & R. S. MARS Co., 322-324 W. Michigan St., Duluth, Minn., distributor for the company.

Coming Events

SEPTEMBER 12-16—FOURTH NATIONAL INSTRUMENT CONFERENCE AND EXHIBIT in the Municipal Auditorium, St. Louis, Mo.

SEPTEMBER 21-24 — Twenty-sixth annual convention of the NATIONAL ASSOCIATION OF FOREMEN at the Statler Hotel, Detroit, Mich. Headquarters of the Association, 321 W. First St., Dayton 2, Ohio.

SEPTEMBER 26-28—NATIONAL ELECTRONICS CONFERENCE at the Edgewater Beach Hotel in Chicago, Ill. Sponsored by the Illinois Institute of Technology, Chicago 16, Ill.

SEPTEMBER 28-30—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Lawrence Hotel, Erie, Pa. Executive assistant secretary, Ernest Hartford, 29 W. 39th St., New York 18, N. Y.

OCTOBER 10-14 — National meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS in San Francisco, Calif.; headquarters, Fairmont Hotel. Headquarters of the Society, 1916 Race St., Philadelphia 3, Pa.

OCTOBER 17-21 — NATIONAL METAL CONGRESS and EXPOSITION to be held in connection with the thirty-first annual meeting of the AMERICAN SOCIETY FOR METALS at the Public Auditorium in Cleveland, Ohio. National secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 17-21—Fall meeting of the METALS BRANCH, AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, in Cleveland, Ohio. Secretary, E. H. Robie, 29 W. 39th St., New York 18, N. Y.

OCTOBER 17-21—Annual meeting of the AMERICAN SOCIETY FOR METALS in Cleveland, Ohio. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 17-21—Annual meeting of the AMERICAN WELDING SOCIETY in Cleveland, Ohio. Executive secretary, Joseph G. Magrath, 33 W. 39th St., New York 18, N. Y.

OCTOBER 24-28—Thirty-seventh NATIONAL SAFETY CONGRESS and EXPOSITION in Chicago, Ill. R. L. Forney, general secretary, National Safety Council. 201 N. Wacker Drive, Chicago 6.

OCTOBER 27-29—Seventeenth semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS at the Mount Royal Hotel, Montreal, Canada. Executive secretary, H. E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

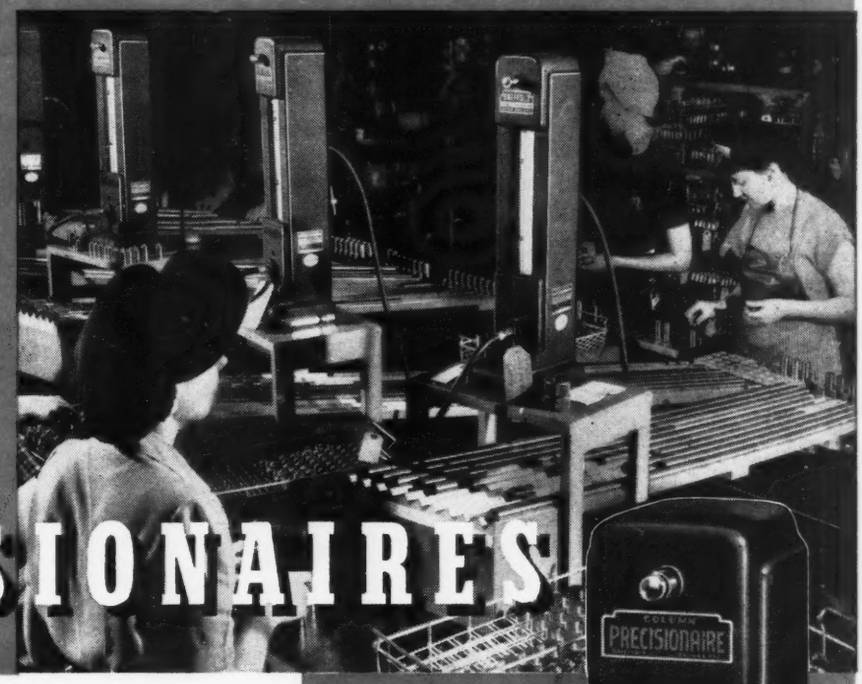
NOVEMBER 1-5—PACIFIC CHEMICAL EXPOSITION and PACIFIC INDUSTRIAL CONFERENCES at the San Francisco Civic Auditorium, San Francisco, Calif. Chairman of California Section, American Chemical Society, Dr. Richard Wistar, Hotel Whitcomb, San Francisco 1, Calif.

NOVEMBER 30-DECEMBER 2—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS at the Hotel New Yorker, New York City. For further information, address the Society at P.O. Box 168, Cambridge 39, Mass.

MARCH 28-31, 1950—FOURTH NATIONAL PLASTICS EXPOSITION at the Navy Pier, Chicago, Ill. Sponsored by the SOCIETY OF THE PLASTICS INDUSTRY. William T. Cruse, executive vice-president, 295 Madison Ave., New York 17, N. Y.

A unique type of punch press of 30 tons rated capacity, with an exceptionally large bolster area, is being demonstrated to dealers and potential customers through a unique method of sales presentation by the Diamond Machine Tool Co., Los Angeles, Calif. This "Multi-Max" punch press is being transported on a 1 1/2-ton truck to all the principal cities of the country where the company's dealers are located. The purpose of this mobile exhibit is to help to educate the dealers' salesmen on the features of the press. The Diamond 9-ton bench press and the Model B-12 milling machine also form part of the exhibit

Cut YOUR COST PER PIECE WITH SHEFFIELD PRECISIONAIRES



and keep quality competitive

Precisionaires positively measure internal and external dimensions to the accuracy required on the production line, in the toolroom, or in the laboratory.

These trustworthy instruments for reliable dimensional control are universally used for cutting costs and protecting quality. They speed up inspection time and cut the cost of gages.

Scrap is reduced—more good parts are accepted—assembly time is cut—inspection costs go down—quality goes up.

get the "W-HOLE" story

5377

NEW FEATURES

- Linear Column
- Linear Scale
- 80% Reduction in use of air
- Float Positioner
- Wear Compensation Adjustment
- Dual Control of Air Flow
- Dual Filtering of Air
- Wider range of amplifications
- Broader field proven applications

Send this coupon for new 28 page Precisionaire Application Handbook and see how users are cutting costs per piece while maintaining competitive quality.

NAME_____

POSITION OR TITLE_____

COMPANY_____

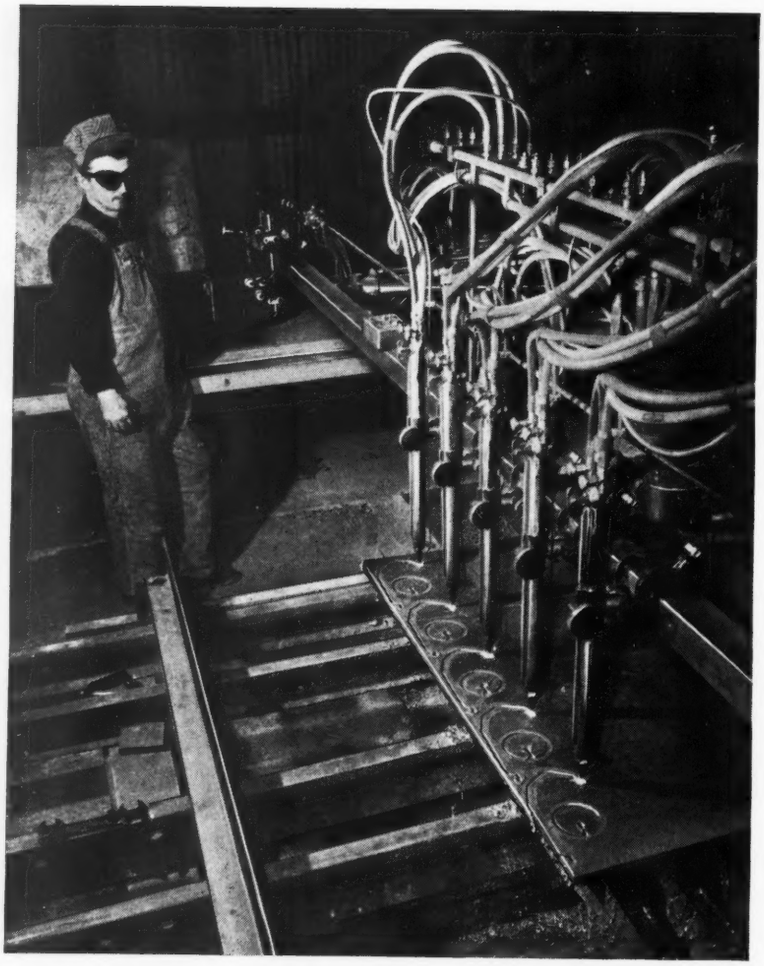
STREET_____

CITY_____ ZONE ____ STATE_____

the *Sheffield* corporation

Dayton 1, Ohio, U.S.A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • THREADING TOOLS



Airco No. 41 Travograph oxy-acetylene cutting machine equipped with an electronic tracing device in operation in the Buffalo plant of Joseph T. Ryerson & Son, Inc.

Coast-to-Coast Applications of Electric Eye Flame-Cutting Equipment

Joseph T. Ryerson & Son, Inc., has installed eleven Airco No. 41 Travograph oxy-acetylene cutting machines, each equipped with an electronic tracing device, in Ryerson plants from New York to San Francisco. The electronic tracing device is said to permit cuts that are unobtainable by other methods and, in addition, eliminates the time required to make templets and does away with the problem of storing templets.

The need for such an elaborate installation of flame-cutting equipment was justified by the almost endless variety of shapes that are flame cut from steel plate in Ryerson warehouses and by the fact that thousands of jobs of this kind are handled annually.

Educational Lecture Service on Use of Files

The Nicholson File Co., Providence, R. I., is making available an educational lecture service on the selection and use of the right file for any particular job. The lectures are given by Walter R. Buerckel, of the Nicholson organization, with the object of increasing efficiency in filing operations in large industrial plants. They are illustrated by slides, and are so prepared that they are simple enough for trainees to understand and yet sufficiently technical to interest experienced men. The service is offered without charge. Complete information can be obtained from the company.

* * *

Statisticians of one automotive company have figured that cars selling for about $1500 today would have cost more than $50,000 if built with the tools used in 1908.

Obituaries

Edward J. Burnell

Edward J. Burnell, vice-president, general sales manager, and director of the Link-Belt Co., Chicago, Ill., died at his home in Winnetka, Ill., on July 22, after an illness of several months. Mr. Burnell was born in Tondu, Wales, on April 7, 1888. He came to this country with his family and lived in Catasauqua, Pa. He was graduated from Lehigh University in 1910.

Mr. Burnell served the Link-Belt Co., in many important capacities connected with engineering, sales, and plant management. He was a director of the American Mining Congress, Foundry Equipment Manufacturers Association, and Conveyor Equipment Manufacturers Association. During the war, he served on the advisory boards of the Machinery Branch of the War Production Board and the Chemical Corps of the War Department, and as a consultant to the Reconstruction Finance Corporation. He leaves a wife and two children.

William F. Slomer

William F. Slomer, former general sales manager of the Fellows Gear Shaper Co., Springfield, Vt., died at his summer residence in Hendersonville, N. C., on August 4, at the age of seventy-one years. Mr. Slomer was born in Covington, Ky., on November 2, 1877, and became associated with the Fellows Gear Shaper Co. in 1903. In 1908, he was made general sales manager, with headquarters in Detroit, Mich. He retired in 1938 because of ill health. Since then he has been residing in Fort Lauderdale, Fla., and in Hendersonville. Mr. Slomer was well known in automotive and allied industries, and contributed greatly to the success of the firm with which he was connected. He is survived by his wife and a daughter.

JAMES M. DAVIDSON, superintendent of the Buffalo plant of the Farrel-Birmingham Co., Inc., died suddenly on July 15 at the Millard Fillmore Hospital, following a brief illness. Mr. Davidson's entire business career was spent with the company, and his appointment to the position of plant superintendent in 1946 climaxed his steady progress from the time of his first employment as office boy in 1920.

ORRIN H. BAKER, sales manager of the railroad materials and commercial forgings division of the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa., died on July 13 at the age of sixty-four years.

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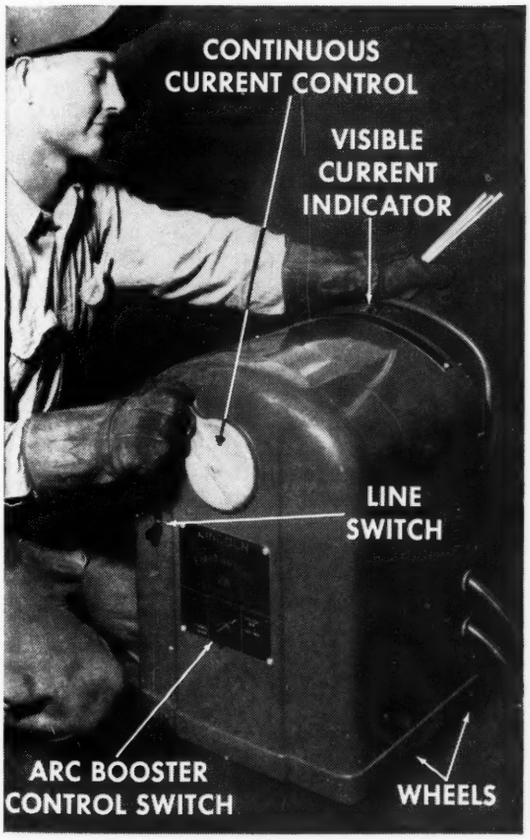

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New Books and Publications

TOOL ENGINEERS' HANDBOOK. Editor-in-chief, Frank W. Wilson. 2070 pages, 6 by 9 inches; 2000 charts, tables, and diagrams. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. Price to non-members, $15; to members, $11.

This new handbook, prepared by the American Society of Tool Engineers, is practically encyclopedic in scope. It covers the field of mechanical manufacturing industries, including various phases of planning, control, design, tooling, and operations. The writing of the book represents the combined efforts of a large number of men, and took five years' time.

There are 115 sections in the book, which may be classified under the following twelve major headings: Planning and Control of Production, Inspection, and Quality; Materials and Machinability; Casting and Extruding Operations; Metal Cutting, Grinding, and Finishing; Metal Forming; Welding, Gluing, and Mechanical Joining of Materials; Surface Finish and Protective Coatings, Peening, and Balancing; Gaging, Inspection, and Testing; Fixture, Die, and Tool Design; Machine Tool Controls and Feeding Devices; Design of Threads, Gears, Bearings, Springs, and Other Elements; and Mathematics, Physics, and Reference Tables.

The Handbook was planned to integrate and present in one volume the widely scattered technical data developed by the members of the Society; operating methods and standards of producing companies; national and association standards; proceedings of engineering societies and institutes; and published findings of the technical press.

PLANT PRODUCTION CONTROL FOR FACTORY OPERATIONS. By Charles A. Koepke. 568 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.50.

This book, of which this is the second edition, was written to demonstrate methods of controlling the flow of materials through any type of industrial enterprise. The material included in the second edition is the outgrowth of an extensive consulting practice in many types of industries and revisions have been made to incorporate current practices.

An idea of the detailed treatment of the subject will be obtained from the following list of chapter headings: An Analysis of Some Production Factors; Scope of Production Control; Organization for Production Control; Product Design or Specification; Materials, Their Classification and Selection; Ordering, Receiving, Storing, and Issuing Materials; Standardization to Aid Production; Process Analysis and Methods of Production; Small Tools and Tool Cribs; Routing Operation Sheets, and Instruction Cards; Estimating Production and Costs; Inspection; Plant Capacity, Maintenance, and Repair; Machine Replacement; Cooperation with Cost Accounting; Coordination of Sales and Manufacturing; Planning for the Production Program; Inventory Control; Economic Lot Sizes; Scheduling and Releasing Orders; Machine Loads; Production Control Forms; Dispatching and Internal Transportation; and Measures of Factory Performance.

STRENGTH OF MATERIALS. By Charles O. Harris. 212 pages, 8 1/4 by 11 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. Price, $4.90.

This book was prepared not only for engineering students, but also for others in industry who require basic knowledge of the strength of materials. The arrangement of the book has been planned with the needs of students especially in mind. Each topic is developed step by step, and many illustrative examples are included. A set of practice problems follows each topic, and a summary at the end of every chapter lends additional emphasis to the points discussed. Care has been taken to acquaint the student with new materials now being used in industry.

The material is divided into twelve chapters under the following subject headings: Introduction to Strength of Materials; Equilibrium of Bodies; Simple Stress and Strain; Centroid of an Area; Moment of Inertia of Area; Riveted, Bolted, or Welded Joints; Stresses in Beams; Bending Moment Combined with Tension or Compression; Shafts Subjected to Torsion; Bending Moment Combined with Torque; Compression Members; and Repeated Stress.

HISTORY OF THE TOOLS DIVISION, WAR PRODUCTION BOARD. By Bradley Stoughton. 154 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $4.

An intimate record of the organization and activities of the Tools Division of the War Production Board is presented in an informal and readable manner in this book. While this is not intended to be a complete history of this important branch of the War Production Board, it outlines the difficulties encountered and the achievements of the Tools Division in building up the "Arsenal of Democracy," with especial emphasis on the men and women who worked loyally and self-sacrificingly together on this enterprise. The book contains 147 photographs of individuals, in addition to 16 group photographs, and it is believed that practically every member of the Division is pictured in these illustrations. A complete list of the members is included. This behind-the-scenes account of the organized effort to stimulate the production of machine tools and to make the best possible use of those available emphasizes the important part played by the machine tool and allied industries in winning the war.

ENGINEERING OPTICS. By K. J. Habell and Arthur Cox. 411 pages, 5 1/2 by 8 1/2 inches. Published by the Pitman Publishing Corporation, 2 W. 45th St., New York 19, N. Y. Price, $7.50.

In this treatise, a critical survey is made of the most important optical methods and instruments applicable to engineering practice. There are two preliminary chapters on the fundamental properties and limitations of optical systems, followed by chapters dealing with microscopes, telescopes, and other optical instruments, as well as the effects of light and illumination and methods of optical projection. The book is not a text-book on optical design, but is intended primarily for engineers using optical equipment.

INDUSTRIAL ENGINEERING SURVEY. By Ralph M. Barnes. 47 pages, 8 1/2 by 11 inches. Published by the Wm. C. Brown Co., 915 Main St., Dubuque, Iowa. Price, $1.

This pamphlet contains the results of two surveys of more than eighty companies made by the author, who is professor of industrial engineering and director of personnel at the College of Engineering, University of Iowa. The subjects covered were number of employes, hours of work, wages, incentive plans, time studies, etc.

BIBLIOGRAPHY ON PRECISION INVESTMENT CASTING BY THE LOST WAX PROCESS. 15 pages, 8 1/2 by 11 inches. Compiled by the Engineering Societies Library, 39 W. 39th St., New York 18, N. Y. Price, $2.50.

This pamphlet contains a list of 111 books and articles published up to early 1949 on the precision investment casting process, covering theory, design problems, industrial applications, and factory and production methods.